Port of Seattle
Lora Lake Apartments Site

2022 Annual Compliance Monitoring Report

Prepared for

Port of Seattle
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LIMITATIONS

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2022 Annual Compliance Monitoring Report

This document was prepared for
The Port of Seattle
under the supervision of:

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Date: November 29, 2022

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List of Abbreviations

Abbreviation	Definition
ARI	Analytical Resources, Inc.
CD	Consent Decree
CMP	Compliance Monitoring Plan
DMCA	1982 Dredged Material Containment Area
Ecology	Washington State Department of Ecology
µg/L	Micrograms per liter
pg/g	Picograms per gram
pg/L	Picograms per liter
Port	Port of Seattle
Site	Lora Lake Apartments Site
TEQ	Toxic equivalent
USEPA	U.S. Environmental Protection Agency

1.0 Introduction

This Annual Compliance Monitoring Report was prepared by Floyd|Snider on behalf of the Port of Seattle (Port) to document the compliance monitoring events conducted in 2022 at the Lora Lake Apartments Site (Site) in Burien, Washington. Compliance monitoring activities were conducted in accordance with the 2015 Compliance Monitoring Plan (CMP), as revised and finalized in 2022 (Floyd|Snider 2022).

The objective of this report is to describe the compliance monitoring program activities performed from January through December 2022. This report includes the results from compliance monitoring activities including groundwater compliance monitoring, sediment remedy compliance monitoring, and wildlife barrier and cap performance inspections at the Site. The cumulative data from these events will be used in the first 5-year periodic review, to be conducted following the 2024 monitoring event, to confirm the effectiveness of the remedial action and identify when site-wide compliance with groundwater cleanup standards for the Site have been achieved.

1.1 BACKGROUND

1.1.1 Site Description

The Site is located at 15001 Des Moines Memorial Drive South in Burien, Washington, and straddles the boundary between the Cities of Burien and SeaTac, Washington (refer to Figure 1.1). The Site, as defined by Washington Administrative Code 173-340-200, consists of three areas: the Lora Lake Apartments Parcel, and areas within the Lora Lake Parcel and 1982 Dredged Material Containment Area (DMCA), where contamination has come to be located. Historical operations at the Lora Lake Apartments Parcel included barrel-washing and auto-wrecking operations, which along with site regrading led to soil and groundwater contamination throughout the Site. The Site is owned by the Port and located within the security fencing for the Seattle-Tacoma International Airport with the exception of the portion of the Lora Lake Apartments Parcel owned by the Washington State Department of Transportation (WSDOT), described below. Descriptions of the Site areas are as follows:

- The Lora Lake Apartments Parcel is located on the west side of Des Moines Memorial Drive in the City of Burien and consists of approximately 8.3 acres of previously vacant land. A portion of the Lora Lake Apartments Parcel in the northeast corner was sold to WSDOT in May 2017 for the construction of State Road-518 off-ramp. This area is retained within the Site boundary although no longer owned by the Port. To the south of the Lora Lake Apartments Parcel is the former Seattle City Light Sunnydale Substation Parcel, which was purchased by the Port in 2011. Contamination has come to be located on a portion of the former Sunnydale Substation Parcel and this area therefore falls within the Site boundary.
- The Lora Lake Parcel is located on the east side of Des Moines Memorial Drive in the City of SeaTac and consists of approximately 7.1 acres of land, including the former

approximately 3-acre Lora Lake and a Port-constructed wetland habitat mitigation area.

- The DMCA is an approximately 2.75-acre area located adjacent to the Lora Lake Parcel, to the northeast. The DMCA was constructed in 1982, when King County dredged approximately 4 feet of Lora Lake sediments and placed the dredged material in a specifically constructed facility, now referred to as the DMCA.

The Port and the Washington State Department of Ecology (Ecology) entered a Consent Decree (CD) in September 2015 under the mutual objective of providing remedial action at the Site. The CD required the Port to perform a final cleanup action and associated compliance monitoring at the Site as described in the Cleanup Action Plan (CAP; State of Washington 2015).

1.1.2 Remedial Actions Implemented

As described in the CAP, the remedial actions at the Site were determined for each parcel. The Lora Lake Apartments Parcel remedial actions taken include excavation of soils with a dioxin/furan toxic equivalent (TEQ) greater than 100 picograms per gram (pg/g), construction of a temporary clean soil cap, and future implementation of a constructed engineered surface to contain remaining soils with concentrations greater than the dioxin/furan TEQ cleanup level of 13 pg/g at the time of future site redevelopment. The final engineered surface shall be installed by October 31, 2026, as approved by Ecology via email on September 8, 2021. The excavation and temporary clean soil cap were completed in 2018. The Lora Lake Parcel remedial actions taken include construction of a sand cap, followed by site restoration into an intermittent scrub/shrub wetland. The sand cap was completed in 2019, and the wetland restoration was completed in early 2020. DMCA remedial actions completed include construction of a wildlife barrier. Restrictive Covenants limiting future site uses have been implemented for all parcels, for protection from contact with contamination remaining in place. Restrictive Covenants for the Lora Lake Apartments Parcel, Lora Lake Parcel, DMCA, and the former Sunnydale Substation Parcel were filed with King County on January 28, 2022, after receipt of Ecology signatures. Compliance monitoring of the remedial actions is being conducted under the CMP (Floyd|Snider 2022).

1.1.3 Compliance Monitoring Requirements

In accordance with Washington Administrative Code 173-340-410, compliance monitoring of site groundwater is required to confirm that human health and the environment are adequately protected, the remedial action has achieved the cleanup standards, and the cleanup action remains protective after cleanup standards have been met.

The Ecology-approved CMP includes requirements for each of the three parcels of the Site. Requirements for the Lora Lake Apartments Parcel include analysis of groundwater for arsenic, pentachlorophenol, and dioxins/furans, and four consecutive events with concentrations less than the established cleanup levels throughout the monitoring network prior to termination of sampling. The CMP also includes annual inspections of the soil cap to identify and document

general condition, as well as any areas of exposed underlying soil, loss of barrier material, or substantial plant growth that may impact the functionality of the cap. Once constructed, annual monitoring of the permanent cap (redeveloped surface) will also be required to ensure integrity of the cap.

The Lora Lake Parcel requirements include annual analysis of groundwater for arsenic and dioxins/furans. Groundwater data will be subject to a 5-year periodic review to assess appropriate monitoring frequency for the next 5 years, and subsequent 5-year reviews will set the frequency for the following 5-year period. Additionally, as described in the CMP, sediment remedy compliance will also be evaluated every 5 years, through a statistical comparison of Lora Lake Parcel groundwater quality to site vicinity groundwater quality, for assessment of the sediment cap performance to contain contamination in the now-contained subsurface sediment beneath the restored wetland. The first 5-year period review and sediment remedy compliance evaluation will be conducted after the 2024 monitoring event.

Compliance monitoring requirements at the DMCA include annual wildlife barrier physical inspections to identify and document general condition, as well as any areas of exposed underlying soil, loss of barrier material, or substantial plant growth that may impact the functionality of the wildlife barrier.

2.0 Lora Lake Apartments Parcel

2.1 COMPLIANCE MONITORING PLAN ACTIVITIES COMPLETED

2.1.1 Groundwater Monitoring Completed

Compliance monitoring at the Lora Lake Apartments Parcel began in December 2018. Four consecutive quarters of groundwater samples with pentachlorophenol and dioxin/furan concentrations less than cleanup levels were collected at MW-C1, MW-C2, and MW-C3 during the December 2018, March 2019, June 2019, and September 2019 monitoring events. With Ecology's approval, sampling for pentachlorophenol and dioxin/furan analysis was terminated after the September 2019 event. Sampling for dissolved arsenic continues as discussed below.

Groundwater samples, as described in this report, were collected from the full monitoring network (MW-C1, MW-C2, MW-C3, and MW-C4) on March 30, 2020, and June 20, 2020. In August 2020, Floyd|Snider submitted the *Evaluation of Arsenic in Groundwater at the Lora Lake Apartments Site* memorandum (hereafter referred to as the Arsenic Evaluation Memorandum; Floyd|Snider 2020) to Ecology on behalf of the Port to describe outlier arsenic data trends observed at MW-C2 and propose a change in the monitoring approach.

As described in the Arsenic Evaluation Memorandum, seasonal exceedances of arsenic concentrations correlated with elevated pH and high groundwater table elevation, likely associated with the crushed concrete fill placed after the demolition of the Lora Lake Apartments buildings and excavation of underlying impacted soil. This recycled concrete was placed above the historical high water table elevation but may be impacting pH and arsenic in groundwater during the wet season. Because the pattern observed at MW-C2 is unique to the location and not observed within the rest of the monitoring network, the Port requested termination of quarterly sampling of the full monitoring network. The Port proposed annual sampling of MW-C2 and downgradient location MW-C3 during the wet season to continue to confirm that elevated arsenic concentrations are not migrating off-site.

On September 21, 2020, Ecology approved the proposed approach of terminating quarterly sampling at the Lora Lake Apartments Parcel and coordinating annual sampling of MW-C2 and the downgradient location, MW-C3, concurrent with Lora Lake annual monitoring each spring (refer to Appendix A of the 2020 Annual Compliance Monitoring Report [Floyd|Snider 2021]). Annual monitoring of MW-C2 and MW-C3 will monitor trends and confirm arsenic-impacted waters are not migrating off property. The first round of annual monitoring of MW-C2 and MW-C3 occurred on October 27, 2020, rather than in the spring, due to sampling schedule impacts related to the COVID-19 pandemic. The second and third rounds of annual monitoring of MW-C2 and MW-C3 occurred in March 2021 and March 2022, respectively, on the regular spring schedule. The 2022 annual monitoring is described in this report.

2.1.2 Maintenance Activities Completed

In April 2022, the Port completed maintenance activities for items noted in the March 23, 2022, cap inspection, as detailed in Section 2.4. The Port completed repair of the missing section of fence and mowed site-wide. The maintenance items were completed by April 14, 2022.

2.2 GROUNDWATER COMPLIANCE MONITORING SUMMARY

MW-C2 and MW-C3 were sampled in coordination with the Lora Lake Parcel annual groundwater monitoring event on March 24, 2022. The groundwater monitoring network is presented on Figure 2.1.

Groundwater samples were collected using standard low-flow sampling methods. The collected samples were generally clear, with no apparent odor. Purge water was collected and placed in an on-site, labeled, 55-gallon drum for future disposal by the Port. All samples were submitted to Analytical Resources, Inc. (ARI) under chain-of-custody procedures for analysis of arsenic. Groundwater sample collection forms for the event are included in Appendix A.

2.3 GROUNDWATER ANALYTICAL SUMMARY

This section summarizes the analytical results for arsenic. Analytical results are presented in Figure 2.1 and Table 2.1, and laboratory reports and data validation summaries are included in Appendix B.

2.3.1 Arsenic

The arsenic concentrations in the sample collected from MW-C3 was 0.19 micrograms per liter (µg/L), less than the Site cleanup level of 5 µg/L. The arsenic concentration in the sample collected from MW-C2 was 24 µg/L, exceeding the Site cleanup level.

The elevated arsenic concentration on March 24, 2022, is consistent with the trend observed between 2019 and 2021. The likely cause of elevated arsenic at MW-C2 was evaluated and described in Section 2.1.1 and in the Arsenic Evaluation Memorandum (Floyd|Snider 2020).

2.3.2 Data Validation

A Compliance Screening (Stages 1 and 2A) data quality review was performed on metals data resulting from laboratory analysis by U.S. Environmental Protection Agency (USEPA) Methods 200.8. The analytical data were validated by Floyd|Snider in accordance with the USEPA *National Functional Guidelines for Inorganic Superfund Methods Data Review* (USEPA 2020).

For all analyses, the analytical holding times were met, and the method blanks had no detections. The surrogate, matrix spike, matrix spike duplicate, and laboratory control sample recoveries and sample/sample duplicate relative percent differences all met USEPA requirements. No qualifiers were added to the analytical results for metals based on the data quality review. Metals data are determined to be of acceptable quality for use as reported by the laboratory, with some

laboratory qualifiers being updated to conform to the final qualifiers used for data table reporting and database storage.

2.4 TEMPORARY SOIL CAP INSPECTION

On March 23, 2022, a cap inspection was conducted to document the integrity of the temporary soil cap that was installed at the Lora Lake Apartments Parcel in October 2017. The cap inspection was conducted in accordance with the CMP. During the cap inspection, the following items were noted for maintenance: (1) areas in need of vegetation replacement near the biofiltration swale at the southeast portion of the property and along the northern fence line of the property, (2) a missing section of fence located at the southwest corner of the property near the former Sunnydale Substation Parcel, and (3) site-wide plant overgrowth requiring general maintenance and landscaping. The temporary soil cap inspection log and photographs are included in Appendix C.

Instruction for required maintenance of the temporary soil cap was provided to the Port as part of required landscape operations and maintenance. Maintenance activities were completed on the Lora Lake Apartments Parcel in April 2022, as described in Section 2.1.2. Appendix D includes photographs of post-maintenance site conditions. Photographs reflect natural reseeding and/or moss growth in areas previously marked for maintenance due to vegetation loss and exposed soils, fence repairs, and site-wide maintenance and landscaping of plant overgrowth.

3.0 Lora Lake Parcel

3.1 COMPLIANCE MONITORING PLAN ACTIVITIES COMPLETED

3.1.1 Groundwater Monitoring Completed

Annual monitoring was completed at the Lora Lake Parcel in October 2020 and March 2021. The third round of annual monitoring occurred on March 23 and 24, 2022, and is described in this report. In accordance with the CMP, on-site and vicinity well locations were sampled for arsenic and dioxins/furans. The full monitoring network includes on-site well locations MW-CP1, MW-CP2, MW-CP3, MW-CP4, MW-CP5, MW-CP6, and MW-CP-7, as well as vicinity well locations MW-C1/VB1, MW-VB2, MW-VB3, and HCOO-B312 (Figure 3.1).

3.1.2 Maintenance Activities Completed

No maintenance actions were identified for the Lora Lake Parcel, and no maintenance activities were conducted during the year.

3.2 GROUNDWATER COMPLIANCE MONITORING SUMMARY

This section summarizes the compliance monitoring events at the Lora Lake Parcel in 2022. The monitoring network is presented in Figure 3.1, and the groundwater sample collection forms are in Appendix A.

The full monitoring network (MW-CP1, MW-CP2, MW-CP3, MW-CP4, MW-CP5, MW-CP6, MW-CP-7, MW-C1/VB1, MW-VB2, MW-VB3, and HCOO-B312) was sampled on March 23 and 24, 2022. Groundwater samples were collected using standard low-flow groundwater sampling methods. Duplicate samples were collected at MW-C1/VB1 and MW-CP1 for laboratory quality control. Samples were generally clear with no visible turbidity and no apparent odor. Purge water was collected and placed in an on-site, labeled, 55-gallon drum for future disposal by the Port. All samples were submitted to ARI under chain-of-custody procedures for analysis of arsenic and dioxins/furans.

3.3 GROUNDWATER ANALYTICAL SUMMARY

This section summarizes the analytical results for arsenic and dioxins/furans. Analytical results are presented in Figure 3.1 and Table 3.1, and laboratory reports and data validation summaries are included in Appendix B.

3.3.1 Arsenic

Arsenic concentrations in all samples collected from all on-site wells and all vicinity wells were less than the Site cleanup level of 5 µg/L. Within the monitoring well network, arsenic concentrations were typically less than 1 µg/L, with the exception of an arsenic concentration of 3.7 µg/L detected at MW-CP5 located south of the former Lora Lake footprint (Figure 3.1).

3.3.2 Dioxins/Furans

Dioxin/furan concentrations from all on-site wells and vicinity wells were less than the Site cleanup level of 6.7 picograms per liter (pg/L). Dioxins/furans were detected in two of the on-site wells (MW-CP1 and MW-CP6) at concentrations of 2.29 pg/L and 1.94 pg/L, respectively. Dioxin/furan TEQ was additionally detected in two vicinity wells (MW-VB2 and HCOO-B312) at concentrations of 1.91 pg/L and 2.43 pg/L, respectively.

3.3.3 Data Validation

A Compliance Screening (Stages 1 and 2A) data quality review was performed on metals data resulting from laboratory analysis by USEPA Method 200.8. The analytical data were validated by Floyd|Snider in accordance with the USEPA *National Functional Guidelines for Inorganic Superfund Methods Data Review* (USEPA 2020). A Full Validation (Level IV, Tier III Data Quality Review) was performed on dioxin/furan data resulting from laboratory analysis by USEPA Method 1613B. The dioxin/furan data were validated by EcoChem. EcoChem data validation reports are included in Appendix B.

For all analyses, the analytical holding times were met, and the method blank had no detections. The matrix spike and laboratory control sample recoveries and sample/sample duplicate relative percent differences all met USEPA requirements.

No qualifiers were added to the analytical results based on the data quality review. Metals data are determined to be of acceptable quality for use as reported by the laboratory. Data validation qualifiers were added to the analytical results for dioxins/furans, as needed. Dioxin/furan data, as qualified, were also determined to be acceptable for use.

3.3.4 Sediment Remedy Confirmation Monitoring

As detailed in the CMP, the sediment cap is designed to achieve compliance with surface water quality criteria at the cap surface. The surface water quality criterion of 0.005 pg/L dioxin/furan TEQ is significantly less than current laboratory PQLs. As described in the CMP, statistical comparison of groundwater confirmation samples collected within and downgradient of the former Lora Lake cleanup area to vicinity background groundwater samples will be conducted for confirmation of the sediment remedy performance. This statistical comparison method for confirmation monitoring samples provides a measurable method to determine if groundwater samples collected immediately above the sediment cap are different than samples collected from site vicinity background locations. This statistical analysis will be conducted after 5 years of annual monitoring, after the 2024 monitoring event, to provide vicinity background and site data sets with a minimum of 20 results each. Statistical comparison will be conducted in accordance with the procedures described in the CMP.

4.0 1982 Dredged Material Containment Area

4.1 WILDLIFE BARRIER INSPECTION

The DMCA wildlife barrier was inspected on March 24, 2022. Dust and organic debris associated with a large deciduous tree were documented at the southwest corner (station DMCA 09) of the DMCA area during the inspection. Dust and organic debris were also noted along the west cap boundary and at the northeast corner of the cap. The noted dust and organic debris will be cleared following leaf fall in the fall/winter. Overall, the general integrity and condition of the pervious pavement was in good condition, with no deficiencies observed. The wildlife barrier inspection log and photographs are included in Appendix C.

5.0 Upcoming Events and Next Steps

5.1 2023 COMPLIANCE MONITORING

Annual groundwater and sediment remedy compliance monitoring at the Lora Lake Parcel will continue with the fourth annual monitoring event in spring 2023. Annual groundwater sampling of Lora Lake Apartments Parcel well locations MW-C2 and MW-C3 for arsenic monitoring will be coordinated with the Lora Lake Parcel sampling schedule.

The temporary soil cap at the Lora Lake Apartments Parcel and the wildlife barrier at the DMCA will be inspected concurrent with the annual groundwater and sediment remedy compliance monitoring event.

6.0 References

Floyd|Snider. 2020. *Evaluation of Arsenic in Groundwater at the Lora Lake Apartments Site.* Memorandum from Adia Jumper, Mark Jusayan, and Megan King, Floyd|Snider, to Sunny Becker, Washington State Department of Ecology. 17 August.

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_____. 2022. *Port of Seattle Lora Lake Apartments Site Compliance Monitoring Plan.* Originally published September 2015, revised May 2020 and January 2022.

State of Washington. 2015. *Consent Decree re: Lora Lake Apartments Site, Burien, Washington*. 9 September.

U.S. Environmental Protection Agency (USEPA). 2020. *National Functional Guidelines for Inorganic Superfund Methods Data Review*. EPA-540-R-20-006. November.

Lora Lake Apartments Site

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Tables

Table 2.1
Lora Lake Apartments Parcel Groundwater Analytical Data

Location Name				MW-C1												
Sample ID				MW-C1-121218	MW-C1-121218-D	MW-C1-031519	MW-C1-031519-D	MW-C1-062119	MW-C1-062119-D	MW-C1-092019	MW-C1-092019-D	MW-C1-121819	MW-C1-121819-D	MW-C1-033020	MW-C1-033020-D	MW-C1-061720
Sample Date				12/12/2018	12/12/2018	3/15/2019	3/15/2019	6/21/2019	6/21/2019	9/20/2019	9/20/2019	12/18/2019	12/18/2019	3/30/2020	3/30/2020	6/17/2020
Analyte	**CAS No.**	**Site CUL**	**Units**													
Dissolved Metals by USEPA 200.8																
Arsenic	7440-38-2	5	µg/L	0.11 JQ	0.11 JQ	0.11 JQ	0.096 JQ	0.15 JQ	0.12 JQ	0.16 JQ	0.15 JQ	0.10 JQ	0.091 JQ	0.12 JQ	0.13 JQ	0.14 JQ
Phenols by USEPA 8041A																
Pentachlorophenol	87-86-5	1	µg/L	0.025 U	0.025 U	0.025 U	0.025 U	0.025	0.025	0.025 U	0.025 U					
Dioxins/Furans by USEPA 1613B																
2,3,7,8-TCDD	1746-01-6	--	pg/L	0.520 U	0.290 U	2.68 U	1.65 U	1.01 U	0.860 U	2.11 U	1.53 U					
1,2,3,7,8-PeCDD	40321-76-4	--	pg/L	0.490 U	0.350 U	3.25 U	1.64 U	1.02 U	0.990 U	1.17 U	1.48 U					
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/L	0.470 U	0.330 U	3.02 U	1.71 U	0.850 U	0.920 U	1.28 U	1.83 U					
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/L	0.430 U	0.320 U	2.95 U	1.72 U	0.790 U	0.860 U	1.11 U	1.68 U					
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/L	0.470 U	0.340 U	3.11 U	1.79 U	0.850 U	0.920 U	1.22 U	1.80 U					
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/L	1.48 U	0.980 U	11.0 U	2.11 UJ	1.54 UJ	1.24 UJ	2.04 U	1.60 U					
OCDD	3268-87-9	--	pg/L	3.37 J	5.71 J	148 J	9.90 J	4.65 UJ	5.59 UJ	7.48 UJ	15.5 U					
2,3,7,8-TCDF	51207-31-9	--	pg/L	0.380 U	0.340 U	2.64 U	1.67 U	1.32 U	1.10 U	1.95 U	1.45 U					
1,2,3,7,8-PeCDF	57117-41-6	--	pg/L	0.450 U	0.310 U	3.47 U	1.71 U	1.89 UJ	1.50 U	1.16 U	1.42 U					
2,3,4,7,8-PeCDF	57117-31-4	--	pg/L	0.410 U	0.280 U	3.14 U	1.53 U	1.43 U	1.24 U	0.930 U	1.15 U					
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/L	0.260 U	0.240 U	1.80 U	1.01 U	0.470 UJ	0.430 U	0.980 U	1.34 U					
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/L	0.260 U	0.250 U	1.86 U	1.01 U	0.500 UJ	0.450 UJ	0.960 U	1.42 U					
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/L	0.280 U	0.650 U	2.10 U	1.11 U	0.530 UJ	0.460 U	1.04 U	1.45 U					
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/L	0.260 U	0.240 U	1.66 U	0.960 U	0.450 UJ	0.410 UJ	0.980 U	1.34 U					
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/L	0.270 U	0.290 U	1.74 U	1.20 U	0.420 UJ	0.580 UJ	1.02 U	0.720 U					
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/L	0.370 U	0.250 U	2.36 U	1.70 UJ	0.600 UJ	0.860 UJ	1.69 U	1.06 U					
OCDF	39001-02-0	--	pg/L	1.22 UJ	0.860 UJ	11.2 UJ	4.23 UJ	1.53 UJ	1.99 UJ	2.65 UJ	2.15 U					
Dioxin/furan TEQ	--	6.7	pg/L	0.726 J	0.512 J	4.57 J	2.48 J	1.56 UJ	1.43 UJ	2.30 UJ	2.33 U					

Notes:

Blank cells are intentional.

-- Not available.

1 In 2018, location MW-C4 was found to be filled with sand and was not sampled in December 2018, March 2019, or June 2019. Following coordination with Ecology, this well was abandoned and a replacement well was installed within a few feet of the original well location in August 2019.

BOLD/RED Analyte detected at a concentration greater than the site cleanup level.

Abbreviations:

CAS Chemical Abstracts Service
CUL Cleanup level
Ecology Washington State Department of Ecology
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
µg/L Micrograms per liter
OCDD Octachlorodibenzodioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/L Picograms per liter
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxic equivalent
USEPA U.S. Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
JQ Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.
U Analyte was not detected at the given reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table 2.1
Lora Lake Apartments Parcel Groundwater Analytical Data

			Location Name	MW-C1 (Cont.)	MW-C2										MW-C3	
			Sample ID	MW-C1-061720D	MW-C2-121218	MW-C2-031519	MW-C2-062119	MW-C2-092019	MW-C2-121819	MW-C2-033020	MW-C2-061720	MW-C2-102820	MW-C2-031621	MW-C2-032422	MW-C3-121218	MW-C3-031519
			Sample Date	6/17/2020	12/12/2018	3/15/2019	6/21/2019	9/20/2019	12/18/2019	3/30/2020	6/17/2020	10/28/2020	3/16/2021	3/24/2022	12/12/2018	3/15/2019
Analyte	**CAS No.**	**Site CUL**	**Units**													
Dissolved Metals by USEPA 200.8																
Arsenic	7440-38-2	5	µg/L	0.14 JQ	2.6	**14**	3.7	2.1	1.9	**27**	**11**	3.1	**22**	**24**	0.24	0.26
Phenols by USEPA 8041A																
Pentachlorophenol	87-86-5	1	µg/L		0.062	0.69	0.051	0.031							0.025 U	0.025 U
Dioxins/Furans by USEPA 1613B																
2,3,7,8-TCDD	1746-01-6	--	pg/L		0.370 U	2.41 U	1.94 U	1.95 U							0.350 U	0.650 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/L		0.440 U	3.25 U	1.82 U	1.17 U							0.330 U	0.670 U
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/L		0.530 U	3.69 U	1.20 U	1.50 U							0.390 U	0.770 U
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/L		0.900 U	4.96 J	1.11 U	1.29 U							0.380 U	0.730 U
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/L		0.550 U	3.65 U	1.19 U	1.42 U							0.400 U	0.780 U
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/L		22.5	86.5	47.8	14.8							0.520 U	1.03 U
OCDD	3268-87-9	--	pg/L		232 J	553	515 J	126 J							3.23 J	9.11 J
2,3,7,8-TCDF	51207-31-9	--	pg/L		0.450 U	3.49 U	1.87 U	1.69 U							0.310 U	0.710 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/L		0.670 U	2.62 U	1.67 U	1.42 U							0.310 U	0.820 U
2,3,4,7,8-PeCDF	57117-31-4	--	pg/L		0.400 U	2.35 U	1.42 U	1.10 U							0.290 U	0.750 U
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/L		0.550 J	1.87 U	1.26 U	1.11 U							0.180 U	0.540 U
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/L		0.450 U	1.89 U	1.27 U	1.12 U							0.180 U	0.510 U
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/L		0.330 U	2.08 U	1.31 U	1.25 U							0.520 U	0.540 U
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/L		0.530 J	1.70 U	1.15 U	1.10 U							0.180 U	0.500 U
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/L		4.71 J	13.8	12.0 U	3.60 U							0.140 U	0.330 U
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/L		0.580 U	2.03 U	1.84 U	0.740 U							0.180 U	0.440 U
OCDF	39001-02-0	--	pg/L		21.2 J	40.5	45.2 J	13.8 J							0.690 UJ	1.02 U
Dioxin/furan TEQ	--	6.7	pg/L		1.09 J	5.83 J	3.35 J	2.48 J							0.520 J	1.05 J

Notes:

Blank cells are intentional.

-- Not available.

1 In 2018, location MW-C4 was found to be filled with sand and was not sampled in December 2018, March 2019, or June 2019. Following coordination with Ecology, this well was abandoned and a replacement well was installed within a few feet of the original well location in August 2019.

BOLD/RED Analyte detected at a concentration greater than the site cleanup level.

Abbreviations:

CAS Chemical Abstracts Service
CUL Cleanup level
Ecology Washington State Department of Ecology
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
HxCDD Hexachlorodibenzo-p-dioxin
HxCDF Hexachlorodibenzofuran
µg/L Micrograms per liter
OCDD Octachlorodibenzodioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/L Picograms per liter
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxic equivalent
USEPA U.S. Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
JQ Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.
U Analyte was not detected at the given reporting limit.
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Table 2.1
Lora Lake Apartments Parcel Groundwater Analytical Data

Location Name				MW-C3 (Cont.)									MW-C4 [1]			
Sample ID				MW-C3-062119	MW-C3-092019	MW-C3-121819	MW-C3-033020	MW-C3-061720	MW-C3-102820	MW-C3-031621	MW-C3-031621-D	MW-C3-032422	MW-C4-092019	MW-C4-121819	MW-C4-033020	MW-C4-061720
Sample Date				6/21/2019	9/20/2019	12/18/2019	3/30/2020	6/17/2020	10/28/2020	3/16/2021	3/16/2021	3/24/2022	9/20/2019	12/18/2019	3/30/2020	6/17/2020
Analyte	**CAS No.**	**Site CUL**	**Units**													
Dissolved Metals by USEPA 200.8																
Arsenic	7440-38-2	5	µg/L	0.20 JQ	0.22	0.22	0.25	0.22	0.22	0.19 JQ	0.21	0.19 JQ	0.47	0.42	0.37	0.49
Phenols by USEPA 8041A																
Pentachlorophenol	87-86-5	1	µg/L	0.025	0.025 U								0.025 U			
Dioxins/Furans by USEPA 1613B																
2,3,7,8-TCDD	1746-01-6	--	pg/L	2.01 U	1.71 U								1.73 U			
1,2,3,7,8-PeCDD	40321-76-4	--	pg/L	1.14 U	1.34 U								0.980 U			
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/L	1.02 U	1.55 UJ								0.960 U			
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/L	0.940 U	1.39 U								0.870 U			
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/L	1.01 U	1.50 U								0.930 U			
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/L	1.45 U	1.60 U								1.45 U			
OCDD	3268-87-9	--	pg/L	4.34 J	4.98 UJ								10.7 U			
2,3,7,8-TCDF	51207-31-9	--	pg/L	1.49 U	1.92 U								1.82 U			
1,2,3,7,8-PeCDF	57117-41-6	--	pg/L	1.23 U	1.19 U								1.03 U			
2,3,4,7,8-PeCDF	57117-31-4	--	pg/L	1.00 U	0.960 U								0.850 U			
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/L	0.800 U	0.750 U								0.720 U			
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/L	0.830 U	0.720 U								0.700 U			
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/L	0.870 U	0.830 U								0.750 U			
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/L	0.760 U	0.740 U								0.700 U			
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/L	0.580 U	0.550 U								0.590 U			
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/L	0.750 UJ	0.810 U								0.860 U			
OCDF	39001-02-0	--	pg/L	2.82 UJ	2.76 UJ								2.80 U			
Dioxin/furan TEQ	--	6.7	pg/L	2.15 J	2.17 UJ								1.89 U			

Notes:

Blank cells are intentional.

-- Not available.

1 In 2018, location MW-C4 was found to be filled with sand and was not sampled in December 2018, March 2019, or June 2019. Following coordination with Ecology, this well was abandoned and a replacement well was installed within a few feet of the original well location in August 2019.

BOLD/RED Analyte detected at a concentration greater than the site cleanup level.

Abbreviations:

CAS Chemical Abstracts Service
CUL Cleanup level
Ecology Washington State Department of Ecology
HpCDD Heptachlorodibenzo-p-dioxin
HpCDF Heptachlorodibenzofuran
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HxCDF Hexachlorodibenzofuran
µg/L Micrograms per liter
OCDD Octachlorodibenzodioxin
OCDF Octachlorodibenzofuran
PeCDD Pentachlorodibenzo-p-dioxin
PeCDF Pentachlorodibenzofuran
pg/L Picograms per liter
TCDD Tetrachlorodibenzo-p-dioxin
TCDF Tetrachlorodibenzofuran
TEQ Toxic equivalent
USEPA U.S. Environmental Protection Agency

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
JQ Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.
U Analyte was not detected at the given reporting limit.
UJ Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Table 3.1
Lora Lake Parcel Groundwater Analytical Data

			Location Group	On-Site Wells											
			Location Name	MW-CP1				MW-CP2					MW-CP3		
			Sample ID	MW-CP1-102720	MW-CP1-031721	MW-CP1-032322	MW-CP1-032322-D	MW-CP2-102720	MW-CP2-102720-D	MW-CP2-031721	MW-CP2-031721-D	MW-CP2-032322	MW-CP3-102720	MW-CP3-031721	MW-CP3-032322
			Sample Date	10/27/2020	3/17/2021	3/23/2022	3/23/2022	10/27/2020	10/27/2020	3/17/2021	3/17/2021	3/23/2022	10/27/2020	3/17/2021	3/23/2022
Analyte	CAS No.	Site CUL	Unit												
Dissolved Metals by USEPA 200.8															
Arsenic	7440-38-2	5	µg/L	0.46	0.46	0.55	0.51	0.21	0.24	0.21	0.21	0.33	0.41	0.33	0.97
Dioxin/Furans by USEPA 1613B															
2,3,7,8-TCDD	1746-01-6	--	pg/L	1.05 U	0.580 U	1.38 U	1.19 U	0.960 U	0.800 U	0.630 U	0.450 U	1.44 U	1.03 U	0.800 U	1.31 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/L	0.870 U	0.720 U	1.60 U	1.43 U	0.950 U	0.620 U	0.760 U	0.500 U	1.93 U	0.840 U	0.730 U	1.53 U
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/L	1.37 U	0.780 U	1.74 U	1.44 U	1.06 U	0.780 U	0.700 U	0.660 U	1.69 U	1.36 U	0.650 U	1.75 U
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/L	1.20 U	0.710 U	1.65 U	1.23 U	0.900 U	0.650 U	0.650 U	0.670 U	1.65 U	1.18 U	0.620 U	1.67 U
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/L	1.43 U	0.770 U	1.83 U	1.36 U	1.09 U	0.790 U	0.690 U	0.710 U	1.80 U	1.41 U	0.650 U	1.24 U
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/L	9.24 U	0.990 U	1.79 J	3.19 U	1.68 U	1.26 U	0.820 U	0.620 U	1.64 U	2.03 U	0.700 U	1.78 U
OCDD	3268-87-9	--	pg/L	165 J	6.64 U	17.3 U	15.7 U	27.0 UJ	21.3 UJ	6.64 U	3.10 U	3.60 U	33.0 UJ	9.26 U	3.54 U
2,3,7,8-TCDF	51207-31-9	--	pg/L	1.16 U	0.640 U	1.11 U	0.780 U	1.15 U	0.800 U	0.620 U	0.530 U	0.940 U	1.4 U	0.710 U	0.950 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/L	1.64 U	0.700 U	1.08 U	1.60 U	1.39 U	1.11 U	0.820 U	0.940 U	1.14 U	1.3 U	0.900 U	1.02 U
2,3,4,7,8-PeCDF	57117-31-4	--	pg/L	1.51 U	0.630 U	1.01 U	0.750 U	1.26 U	0.990 U	0.750 U	0.690 U	1.04 U	1.17 U	0.860 U	0.960 U
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/L	0.850 U	0.640 U	1.30 U	1.85 U	0.610 U	0.440 U	0.660 U	0.620 U	1.36 U	0.790 U	0.590 U	1.31 U
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/L	0.880 U	0.660 U	1.35 U	1.83 J	0.570 U	0.430 U	0.670 U	0.630 U	1.39 U	0.740 U	0.590 U	1.30 U
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/L	1.25 U	0.740 U	1.60 U	1.15 U	0.900 U	0.630 U	0.770 U	0.710 U	1.66 U	1.200 U	0.700 U	1.69 U
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/L	0.900 U	0.620 U	1.33 U	0.990 U	0.600 U	0.460 U	0.640 U	0.610 U	1.39 U	0.820 U	0.590 U	1.33 U
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/L	2.35 U	0.620 U	1.18 U	0.900 U	0.560 U	0.550 U	0.550 U	0.940 U	1.15 U	0.880 U	1.13 U	1.25 U
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/L	1.23 U	0.790 U	1.72 U	1.20 U	0.840 U	0.790 U	0.720 U	0.690 U	1.59 U	1.14 U	0.690 U	1.71 U
OCDF	39001-02-0	--	pg/L	20.2 UJ	18.8 U	2.71 U	1.70 U	3.08 UJ	2.88 UJ	12.0 U	6.36 U	2.86 U	2.84 UJ	24.3 U	2.66 U
Dioxin/furan TEQ	--	6.7	pg/L	1.78 J	0.720 U	2.29 J	2.35 J	0.480 UJ	1.14 UJ	0.760 U	0.500 U	1.93 U	0.515 UJ	0.800 U	2.23 U

Notes:

-- Not available.

1 On October 28, 2020, MW-VB2 was dry and samples were unable to be collected.

Abbreviations:

CAS	Chemical Abstracts Service	OCDF	Octachlorodibenzofuran
CUL	Cleanup level	PeCDD	Pentachlorodibenzo-p-dioxin
HpCDD	Heptachlorodibenzo-p-dioxin	PeCDF	Pentachlorodibenzofuran
HpCDF	Heptachlorodibenzofuran	pg/L	Picograms per liter
HxCDD	Hexachlorodibenzo-p-dioxin	TCDD	Tetrachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran	TCDF	Tetrachlorodibenzofuran
µg/L	Micrograms per liter	TEQ	Toxic equivalent
NS	Not sampled	USEPA	U.S. Environmental Protection Agency
OCDD	Octachlorodibenzodioxin		

Qualifiers:

J	Analyte was detected; concentration is considered to be an estimate.
JQ	Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.
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Table 3.1
Lora Lake Parcel Groundwater Analytical Data

			Location Group	Vicinity Wells												
			Location Name	MW-CP4			MW-CP5			MW-CP6			MW-CP7			HCOO-B312
			Sample ID	MW-CP4-102720	MW-CP4-031621	MW-CP4-032322	MW-CP5-102720	MW-CP5-031621	MW-CP5-032322	MW-CP6-102720	MW-CP6-031621	MW-CP6-032322	MW-CP7-102720	MW-CP7-031621	MW-CP7-032322	HCOO-B312-102820
			Sample Date	10/27/2020	3/16/2021	3/23/2022	10/27/2020	3/16/2021	3/23/2022	10/27/2020	3/16/2021	3/23/2022	10/27/2020	3/16/2021	3/23/2022	10/28/2020
Analyte	**CAS No.**	**Site CUL**	**Unit**													
Dissolved Metals by USEPA 200.8																
Arsenic	7440-38-2	5	µg/L	0.098 JQ	0.14 JQ	0.093 JQ	3.2	2.1	3.7	1.1	1.1	0.85	0.42	0.43	0.37	0.17 JQ
Dioxin/Furans by USEPA 1613B																
2,3,7,8-TCDD	1746-01-6	--	pg/L	1.05 U	0.630 U	1.22 U	0.780 U	0.690 U	1.38 U	0.930 U	1.33 U	0.980 U	0.670 U	1.15 U	1.01 U	0.870 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/L	0.940 U	0.950 U	1.31 U	0.670 U	0.930 U	1.66 U	0.920 UJ	2.26 U	1.41 U	0.660 U	1.08 U	1.29 U	0.910 U
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/L	1.41 U	0.960 U	1.53 U	0.670 U	0.720 U	1.55 U	1.40 U	1.95 U	1.50 U	0.810 U	1.36 U	0.940 U	1.08 U
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/L	1.21 U	0.930 U	1.54 U	0.630 UJ	0.720 U	1.44 U	1.20 U	1.93 U	1.44 U	0.680 U	1.29 U	0.890 U	1.00 U
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/L	1.46 U	0.970 U	1.66 U	0.720 U	0.740 U	1.61 U	1.44 U	2.00 U	1.59 U	0.830 U	1.36 U	0.980 U	1.16 U
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/L	2.57 U	1.74 U	1.47 U	2.18 J	2.12 U	1.74 U	1.32 U	1.77 U	2.46 J	3.02 J	1.85 U	1.44 U	1.10 U
OCDD	3268-87-9	--	pg/L	54.1 UJ	5.92 U	5.33 U	23.8 UJ	10.6 U	4.65 U	28.6 UJ	2.46 U	34.6 U	36.1 UJ	10.5 U	3.28 U	10.2 UJ
2,3,7,8-TCDF	51207-31-9	--	pg/L	1.23 U	0.550 U	0.890 U	0.780 U	0.680 U	0.950 U	0.990 U	1.34 U	0.970 U	0.740 U	1.20 U	0.790 U	0.870 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/L	1.83 U	0.850 U	1.20 U	1.32 U	1.07 U	1.09 U	1.53 UJ	1.83 U	1.05 U	1.14 U	1.04 U	1.15 U	1.19 U
2,3,4,7,8-PeCDF	57117-31-4	--	pg/L	1.65 U	0.770 U	1.12 U	1.18 U	0.780 U	1.07 U	1.42 UJ	1.73 U	0.970 U	1.01 U	0.950 U	0.910 U	1.07 U
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/L	0.720 U	0.660 U	1.06 U	0.590 U	0.640 U	1.10 U	0.700 U	1.59 U	1.18 U	0.540 U	1.25 U	0.940 U	0.600 U
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/L	0.650 U	0.630 U	1.07 U	0.570 U	0.670 U	1.07 U	0.690 U	1.63 U	1.22 U	0.500 U	1.25 U	0.960 U	0.570 U
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/L	1.05 U	0.810 U	1.33 U	0.760 U	0.750 U	1.35 U	1.09 U	2.04 U	1.55 U	0.790 U	1.55 U	1.27 U	0.850 U
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/L	0.770 U	0.660 U	1.06 U	0.560 U	0.630 U	1.04 U	0.720 U	1.81 U	1.20 U	0.570 U	1.25 U	0.960 U	0.640 U
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/L	0.600 U	1.07 U	1.06 U	0.680 U	1.26 U	1.25 U	0.660 U	1.02 U	1.12 U	0.510 U	1.43 U	0.760 U	0.590 U
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/L	0.960 U	1.49 U	1.58 U	0.760 U	0.710 U	1.68 U	1.06 U	1.44 U	1.63 U	0.730 U	1.96 U	1.11 U	0.820 U
OCDF	39001-02-0	--	pg/L	5.93 J	18.2 U	2.10 U	4.01 UJ	24.8 U	2.40 U	3.20 UJ	15.3 U	2.08 U	5.16 UJ	25.4 U	2.03 U	2.09 UJ
Dioxin/furan TEQ	--	6.7	pg/L	1.73 J	0.950 U	1.98 U	1.22 J	0.930 U	2.23 U	0.465 UJ	2.26 U	1.94 J	1.15 J	1.15 U	1.73 U	0.455 UJ

Notes:

-- Not available.

1 On October 28, 2020, MW-VB2 was dry and samples were unable to be collected.

Abbreviations:

CAS	Chemical Abstracts Service	OCDF	Octachlorodibenzofuran
CUL	Cleanup level	PeCDD	Pentachlorodibenzo-p-dioxin
HpCDD	Heptachlorodibenzo-p-dioxin	PeCDF	Pentachlorodibenzofuran
HpCDF	Heptachlorodibenzofuran	pg/L	Picograms per liter
HxCDD	Hexachlorodibenzo-p-dioxin	TCDD	Tetrachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran	TCDF	Tetrachlorodibenzofuran
µg/L	Micrograms per liter	TEQ	Toxic equivalent
NS	Not sampled	USEPA	U.S. Environmental Protection Agency
OCDD	Octachlorodibenzodioxin		

Qualifiers:

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Table 3.1
Lora Lake Parcel Groundwater Analytical Data

Location Group				Vicinity Wells (Cont.)												
Location Name				HCOO-B312 (Cont.)		MW-C1/VB1					MW-VB2			MW-VB3		
Sample ID				HCOO-B312-031621	HCOO-B312-032322	MW-C1/VB1-102820	MW-C101-102820	MW-C1/VB1-031721	MW-C1/VB1-032422	MW-C1/VB1-032422-D	--	MW-VB2-031721	MW-VB2-032422	MW-VB3-102720	MW-VB3-031621	MW-VB3-032322
Sample Date				3/16/2021	3/23/2022	10/28/2020	10/28/2020	3/17/2021	3/24/2022	3/24/2022	10/28/2020 [1]	3/17/2021	3/24/2022	10/27/2020	3/16/2021	3/23/2022
Analyte	CAS No.	Site CUL	Unit													
Dissolved Metals by USEPA 200.8																
Arsenic	7440-38-2	5	µg/L	0.17 JQ	0.17 JQ	0.16 JQ	0.16 JQ	0.11 JQ	0.077 JQ	0.090 JQ	NS	0.47	0.35	0.45	0.39	0.38
Dioxin/Furans by USEPA 1613B																
2,3,7,8-TCDD	1746-01-6	--	pg/L	2.89 UJ	1.11 U	0.750 U	0.860 U	0.460 U	1.12 U	1.11 U	NS	0.750 U	1.09 U	1.10 U	0.550 U	1.09 U
1,2,3,7,8-PeCDD	40321-76-4	--	pg/L	3.16 UJ	1.48 U	0.900 U	0.820 UJ	0.560 U	1.55 U	1.49 U	NS	1.00 U	1.41 U	0.910 U	0.510 U	1.72 U
1,2,3,4,7,8-HxCDD	39227-28-6	--	pg/L	3.33 U	1.33 U	1.03 U	0.990 U	1.08 U	1.91 U	1.47 U	NS	0.900 U	1.24 U	1.07 U	0.590 U	1.56 U
1,2,3,6,7,8-HxCDD	57653-85-7	--	pg/L	3.21 U	1.31 U	0.920 U	0.840 U	1.03 U	1.79 U	1.42 U	NS	0.860 U	1.19 U	0.960 U	0.580 U	1.43 U
1,2,3,7,8,9-HxCDD	19408-74-3	--	pg/L	3.36 U	1.43 U	1.08 U	1.02 U	1.08 U	1.99 U	1.56 U	NS	0.910 U	1.31 U	1.13 U	0.600 U	1.61 U
1,2,3,4,6,7,8-HpCDD	35822-46-9	--	pg/L	6.85 UJ	3.78 J	1.76 U	1.42 U	2.16 U	1.53 U	2.91 U	NS	1.32 U	2.02 U	1.74 U	1.25 U	3.18 U
OCDD	3268-87-9	--	pg/L	16.4 UJ	23.3 U	49.1 UJ	66.5 UJ	10.8 U	3.18 U	5.59 U	NS	7.27 U	8.71 U	35.3 UJ	9.72 U	23.9 U
2,3,7,8-TCDF	51207-31-9	--	pg/L	4.22 UJ	0.640 U	1.11 U	0.810 U	0.470 U	0.730 U	0.880 U	NS	0.680 U	0.770 U	1.29 U	0.660 U	0.980 U
1,2,3,7,8-PeCDF	57117-41-6	--	pg/L	4.27 UJ	0.950 U	1.41 U	1.29 U	0.660 U	1.09 U	0.910 U	NS	0.800 U	0.830 J	1.63 U	0.680 U	1.04 U
2,3,4,7,8-PeCDF	57117-31-4	--	pg/L	4.39 UJ	1.70 U	1.36 U	1.18 UJ	0.490 U	1.03 U	0.880 U	NS	0.730 U	0.900 U	1.47 U	0.620 U	1.03 U
1,2,3,4,7,8-HxCDF	70648-26-9	--	pg/L	2.67 U	0.920 U	0.710 U	0.650 U	0.620 U	1.15 U	1.19 U	NS	0.940 U	1.17 U	0.780 U	0.460 U	1.28 U
1,2,3,6,7,8-HxCDF	57117-44-9	--	pg/L	2.67 U	0.970 U	0.730 U	0.590 U	0.590 U	1.17 U	1.18 U	NS	0.890 U	1.15 U	0.690 U	0.450 U	1.29 U
1,2,3,7,8,9-HxCDF	72918-21-9	--	pg/L	6.79 UJ	1.21 U	1.11 U	0.940 U	0.710 U	1.55 U	1.58 U	NS	1.13 U	1.48 U	1.15 U	0.570 U	1.65 U
2,3,4,6,7,8-HxCDF	60851-34-5	--	pg/L	5.20 UJ	1.07 J	0.750 U	0.690 U	0.600 U	1.17 U	1.22 U	NS	1.30 J	1.14 U	0.820 U	0.450 U	1.38 U
1,2,3,4,6,7,8-HpCDF	67562-39-4	--	pg/L	4.44 J	1.28 U	0.660 U	0.770 U	0.550 U	1.01 U	1.18 U	NS	0.820 U	0.840 U	1.35 U	1.24 U	2.17 U
1,2,3,4,7,8,9-HpCDF	55673-89-7	--	pg/L	6.37 UJ	1.89 U	0.940 U	1.25 U	0.700 U	1.52 U	1.64 U	NS	1.16 U	1.23 U	1.30 U	0.680 U	2.03 U
OCDF	39001-02-0	--	pg/L	117 UJ	2.82 U	5.84 UJ	10.2 J	28.9 U	1.96 U	2.36 U	NS	9.61 U	2.61 U	5.29 J	23.3 U	2.50 U
Dioxin/furan TEQ	--	6.7	pg/L	5.45 J	2.43 J	0.450 UJ	1.39 J	0.560 U	2.10 U	2.15 U	NS	1.46 J	1.91 J	1.67 J	0.550 U	2.21 U

Notes:

-- Not available.

1 On October 28, 2020, MW-VB2 was dry and samples were unable to be collected.

Abbreviations:

CAS	Chemical Abstracts Service	OCDF	Octachlorodibenzofuran
CUL	Cleanup level	PeCDD	Pentachlorodibenzo-p-dioxin
HpCDD	Heptachlorodibenzo-p-dioxin	PeCDF	Pentachlorodibenzofuran
HpCDF	Heptachlorodibenzofuran	pg/L	Picograms per liter
HxCDD	Hexachlorodibenzo-p-dioxin	TCDD	Tetrachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran	TCDF	Tetrachlorodibenzofuran
µg/L	Micrograms per liter	TEQ	Toxic equivalent
NS	Not sampled	USEPA	U.S. Environmental Protection Agency
OCDD	Octachlorodibenzodioxin		

Qualifiers:

J	Analyte was detected; concentration is considered to be an estimate.
JQ	Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.
U	Analyte was not detected at the given reporting limit.
UJ	Analyte was not detected; concentration given is the reporting limit, which is considered to be an estimate.

Lora Lake Apartments Site

2022 Annual Compliance Monitoring Report

Figures

Legend

- Combined Groundwater Confirmation and Sediment Cap Performance Site Vicinity Monitoring Location
- Groundwater Confirmation Monitoring Location
- Sediment Cap Performance Monitoring Location
- Sediment Cap Performance Site Vicinity Monitoring Location
- City Boundary
- Lora Lake Apartments Site Extent
- Tax Parcel Boundary

SR 518
CITY OF BURIEN
CITY OF SEATAC
WSDOT PROPERTY
MW-C1/VB1
LORA LAKE APARTMENTS PARCEL
MW-C2
MW-VB2
SOUTH 150TH STREET
MW-C3
FORMER SEATTLE CITY LIGHT SUNNYDALE SUBSTATION
DES MOINES MEMORIAL DRIVE SOUTH
MW-C4
LORA LAKE SHALLOW SOIL
HCOO-B312
1982 DREDGED MATERIAL CONTAINMENT AREA
MW-CP1
MW-VB3
PORT OF SEATTLE PROPERTY
MW-CP2
Former Lora Lake
MW-CP3
SEATTLE-TACOMA INTERNATIONAL AIRPORT 3RD RUNWAY APPROACH LIGHTING SYSTEM
MW-CP4
MW-CP7
MW-CP5
LORA LAKE PARCEL
MW-CP6
8TH AVE SOUTH

Notes:
- Tax parcel boundaries based on King County tax parcel data.
- City boundary data provided by King County.
- Orthoimagery obtained from Nearmap, 2020.

Abbreviation:
WSDOT = Washington State Department of Transportation

0 150 300
Scale in Feet

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2022 Annual Compliance Monitoring Report
Lora Lake Apartments Site
Burien, Washington

Figure 1.1
Site Map

I:\GIS\Projects\POS_LLA\MXD\Task8140\Annual Compliance Monitoring Report\2022\Figure 1.1 Site Map.mxd
10/17/2022

Legend

- Combined Groundwater Confirmation and Sediment Cap Performance Site Vicinity Monitoring Location
- Groundwater Confirmation Monitoring Location
- Sediment Cap Performance Monitoring Location
- Sediment Cap Performance Site Vicinity Monitoring Location
- City Boundary
- Tax Parcel Boundary

Label Key

MW-C3
As:
0.19 JQ

Location Name

Arsenic Result (µg/L)

Notes:
1. Per the *Evaluation of Arsenic in Groundwater at the Lora Lake Apartments Site* memorandum (Floyd|Snider 2020) and subsequent Ecology approval, monitoring at MW-C1 and MW-C4 is no longer required for the Lora Lake Apartments Parcel. However, MW-C1 was renamed MW-C1/VB1 in 2020 and monitoring is ongoing because it serves as a vicinity well for the Lora Lake Parcel. Data is presented on Figure 3.1.

- Results shown in **RED BOLD** exceed the site cleanup level for arsenic of 5 µg/L.
- All results are from samples collected on 3/24/22.
- Analytical results for duplicate samples are not presented.
- Tax parcel boundaries based on King County tax parcel data.
- City boundary data provided by King County.
- Orthoimagery obtained from Nearmap, 2020.

Abbreviations:
As = Arsenic
Ecology = Washington State Department of Ecology
µg/L = Micrograms per liter
WSDOT = Washington State Department of Transportation

Qualifier:
JQ = Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.

0 100 200
Scale in Feet

N

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2022 Annual Compliance Monitoring Report
Lora Lake Apartments Site
Burien, Washington

Figure 2.1
Lora Lake Apartments Parcel
2022 Groundwater Analytical Results

I:\GIS\Projects\POS_LLA\MXD\Task8140\Annual Compliance Monitoring Report\2022\Figure 2.1 Lora Lake Apartments Parcel 2022 Groundwater Analytical Results.mxd
10/19/2022

Legend

- Combined Groundwater Confirmation and Sediment Cap Performance Site Vicinity Monitoring Location
- Groundwater Confirmation Monitoring Location
- Sediment Cap Performance Monitoring Location
- Sediment Cap Performance Site Vicinity Monitoring Location
- City Boundary
- Tax Parcel Boundary

Label Key

MW-C1/VB1
As:
0.16 JQ
D/F:
0.450 UJ

- Location Name
- Arsenic Result (µg/L)
- Dioxin/Furan Result (pg/L)

Notes:
- Cleanup levels for arsenic and dioxins/furans are 5 µg/L and 6.7 pg/L, respectively.
- All results are from samples collected on 3/23/22 or 3/24/22.
- Analytical results for duplicate samples are not presented.
- Tax parcel boundaries based on King County tax parcel data.
- City boundary data provided by King County.
- Orthoimagery obtained from Nearmap, 2020.

Abbreviation:
As = Arsenic
D/F = Dioxins/Furans
µg/L = Micrograms per liter
pg/L = Picograms per liter
WSDOT = Washington State Department of Transportation

Qualifiers:
J = Analyte was detected; concentration is considered to be an estimate.
JQ = Analyte was detected between the method detection limit and reporting limit; concentration is considered to be an estimate.
U = Analyte was not detected at the given reporting limit.

0 150 300
Scale in Feet

N

SR 518
CITY OF BURIEN
CITY OF SEATAC
WSDOT PROPERTY
LORA LAKE APARTMENTS PARCEL
1982 DREDGED MATERIAL CONTAINMENT AREA
PORT OF SEATTLE PROPERTY
FORMER SEATTLE CITY LIGHT SUNNYDALE SUBSTATION
PORT OF SEATTLE PROPERTY
LORA LAKE PARCEL
Former Lora Lake
SEATTLE-TACOMA INTERNATIONAL AIRPORT 3RD RUNWAY APPROACH LIGHTING SYSTEM
8TH AVE SOUTH
DES MOINES MEMORIAL DRIVE SOUTH

MW-C1/VB1
As: 0.077 JQ
D/F: 2.10 U

MW-VB2
As: 0.35
D/F: 1.91 J

HCOO-B312
As: 0.17 JQ
D/F: 2.43 J

MW-C2

MW-C3

MW-C4

MW-CP1
As: 0.55
D/F: 2.29 J

MW-CP2
As: 0.33
D/F: 1.93 U

MW-CP3
As: 0.97
D/F: 2.23 U

MW-CP4
As: 0.093 JQ
D/F: 1.98 U

MW-CP5
As: 3.7
D/F: 2.23 U

MW-CP6
As: 0.85
D/F: 1.94 J

MW-CP7
As: 0.37
D/F: 1.73 U

MW-VB3
As: 0.38
D/F: 2.21 U

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2022 Annual Compliance Monitoring Report
Lora Lake Apartments Site
Burien, Washington

Figure 3.1
Lora Lake Parcel
2022 Groundwater Analytical Results

I:\GIS\Projects\POS_LLA\MXD\Task8140\Annual Compliance Monitoring Report\2022\Figure 3.1 Lora Lake Parcel 2022 Groundwater Analytical Results.mxd
10/19/2022

Lora Lake Apartments Site

2022 Annual Compliance Monitoring Report

Appendix A
Groundwater Sample Collection Forms

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: POS-LL Date of Collection: 3/23/22

Task: March GW Field Personnel: TS

Purge Data

Well ID: HC00B312 Secure: ☑ Yes ☐ No Ecology Tag #: — Casing Type/Diameter/Screened Interval 2"

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) — Stripped (#) — Other Damage: —

Depth Sounder decontaminated Prior to Placement in Well: ☐ Yes ☐ No One Casing Volume (gal): _____

Depth of water (from TOC): 11.13 Time: 14:30

Total Depth (from log or field measurement): _____

After 5 minutes of purging (from top of casing): 11.13

Begin purge (time): 14:36 End purge (time): 15:22

Volume purged: 8.5L Purge water disposal method drum

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (L)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
14:45	11.13	1.5	6.65	1.59	223.7	0.50	11.2	114.3	
14:50	11.13	3	6.24	1.17	223.0	0.37	11.1	111.1	
14:55	11.13	4	5.87	1.02	221.6	0.53	11.1	110.0	
15:00	11.13	5.1	5.78	0.96	220.4	0.30	11.1	109.7	
15:05	11.13	6.5	5.75	0.95	220.0	0.42	11.1	109.1	
15:10	11.13	7.3	5.73	0.88	218.2	0.36	11.2	108.7	

Sampling Data

Sample No: HC00-B312-032322 Location and Depth: 20' BGS

Date Collected (mo/dy/yr): 03/23/22 Time Collected: 15:00 Weather: Rain

Type: ☑ Ground Water ☐ Surface Water Other: — Sample: ☐ Filtered ☑ Unfiltered Filter Type: —

Sample Collected with: ☐ Bailer ☑ Pump Other: — Type: ☑ Peristaltic ☐ Bladder ☐ Submersible Other: _____

Water Quality Instrument Data Collected with: Type: ☑ YSI ProDSS ☑ Tudbidity Meter ☐ Other: _____

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing ☑ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): clear; no odor

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes
		1L Amber	2	—	
		500mL Poly			

QC samples

Duplicate Sample No: — Duplicate Time: — MS/MSD: ☐ Yes ☑ No

Signature: TS Date: 3/23/22

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: POSLA | Date of Collection: 3/24/22

Task: 8140 | Field Personnel: TS

Purge Data

Well ID: MW-21-VB1 | Secure: ☑ Yes ☐ No | Ecology Tag #: _____ | Casing Type/Diameter/Screened Interval: 2"

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) — Stripped (#) — | Other Damage: —

Depth Sounder decontaminated Prior to Placement in Well: ☐ Yes ☐ No | One Casing Volume (gal): _____

Depth of water (from TOC): 7.72 | Time: 11:57

Total Depth (from log or field measurement): _____

After 5 minutes of purging (from top of casing): 7.92

Begin purge (time): 11:58 | End purge (time): 12:57

Volume purged: 8.5L | Purge water disposal method: drum

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (L)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
12:05	7.93	2	7.88	10.26	109.4	0.45	10.0	88.9	
12:10	7.94	4	7.20	10.26	104.6	0.72	10.0	92.3	pump slowed
12:15	7.87	5	6.69	10.16	106.7	0.76	10.2	96.2	
12:20	7.87	6	6.53	10.17	105.5	1.48	10.1	99.1	
12:25	7.87	7	6.46	10.17	104.8	1.33	10.2	101.1	
12:30	7.87	8	6.40	10.15	104.8	1.80	10.2	103.3	

Sampling Data

Sample No: MW-21-VB1-032422 | Location and Depth: _____

Date Collected (mo/dy/yr): 03/24/22 | Time Collected: 12:33 | Weather: Sunny ~60°F

Type: ☑ Ground Water ☐ Surface Water Other: — | Sample: ☐ Filtered ☑ Unfiltered Filter Type: —

Sample Collected with: ☐ Bailer ☑ Pump Other: — | Type: ☑ Peristaltic ☐ Bladder ☐ Submersible Other: —

Water Quality Instrument Data Collected with: Type: ☑ YSI ProDSS ☑ Tudbidity Meter ☐ Other: —

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing; ☑ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): Clear; no odor

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes
		1L Amber	4	—	
		500mL Poly	2	—	

QC samples

Duplicate Sample No: MW-21-VB1-032422-D | Duplicate Time: 12:37 | MS/MSD: ☐ Yes ☑ No

Signature: _____ | Date: 3/24/22

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: PDS-ULA Date of Collection: 3/24/22

Task: 8140 Field Personnel: AJ + TJ

Purge Data

Well ID: MW-C2 Secure: ☑ Yes ☐ No Ecology Tag #: _____ Casing Type/Diameter/Screened Interval _____

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) _____ Stripped (#) _____ Other Damage: _____

Depth Sounder decontaminated Prior to Placement in Well: ☑ Yes ☐ No One Casing Volume (gal): _____

Depth of water (from TOC): 14.14 Time: 11:02

Total Depth (from log or field measurement): _____

After 5 minutes of purging (from top of casing): 14.37

Begin purge (time): 11:03 End purge (time): 11:38

Volume purged: 4L Purge water disposal method: On site drum

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (L)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
11:15	14.37	2	12.33	1.30	1138	1.10	11.0	113.7	
11:20	14.41	2.5	12.23	0.95	1190	1.15	11.1	106.2	
11:25	14.41	3	12.14	0.81	1195	1.23	11.3	100.7	
11:30	14.41	3.5	12.07	0.75	1188	1.20	11.2	95.1	

Sampling Data

Sample No: MW-C2 032422 Location and Depth: _____

Date Collected (mo/dy/yr): 3/24/22 Time Collected: 11:36 Weather: _____

Type: ☑ Ground Water ☐ Surface Water Other: _____ Sample: ☐ Filtered ☐ Unfiltered Filter Type: _____

Sample Collected with: ☐ Bailer ☑ Pump Other: _____ Type: ☐ Peristaltic ☐ Bladder ☐ Submersible Other: _____

Water Quality Instrument Data Collected with: Type: ☑ YSI ProDSS ☑ Tudbidity Meter ☐ Other: _____

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing ☐ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): Yellowish tint, no apparent odor

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes
		125mL poly	1	NONE	

QC samples

Duplicate Sample No: NA Duplicate Time: NA MS/MSD: ☐ Yes ☑ No

Signature: _____ Date: 3/24/22

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: POS-LLA Date of Collection: 3/24/22

Task: 8140 Field Personnel: TS

Purge Data

Well ID: MW-C3 Secure: ☑ Yes ☐ No Ecology Tag #: BKA340 Casing Type/Diameter/Screened Interval 2"

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#)____ Stripped (#)____ Other Damage: ____

Depth Sounder decontaminated Prior to Placement in Well: ☐ Yes ☐ No One Casing Volume (gal): ____

Depth of water (from TOC): 16.21' Time: 11:02

Total Depth (from tog or field measurement): ____

After 5 minutes of purging (from top of casing): 16.25

Begin purge (time): 11:03 End purge (time): 11:33

Volume purged: 4L Purge water disposal method drum

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (L)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
11:15	16.26	1.5	6.33	11.37	77.3	1.01	10.5	187.6	
11:20	16.26	2.3	6.33	11.17	78.8	0.93	10.6	192.5	
11:25	16.26	3.1	6.33	11.06	84.3	0.57	10.6	194.8	
11:30	16.26	4	6.34	10.97	86.7	0.65	10.7	195.1	

Sampling Data

Sample No: MW-C3-032422 Location and Depth: ____

Date Collected (mo/dy/yr): 03/24/22 Time Collected: 11:33 Weather: Cold/Clear

Type: ☑ Ground Water ☐ Surface Water Other: — Sample: ☐ Filtered ☑ Unfiltered Filter Type: —

Sample Collected with: ☐ Bailer ☑ Pump Other: — Type: ☑ Peristaltic ☐ Bladder ☐ Submersible Other: —

Water Quality Instrument Data Collected with: Type: ☐ YSI ProDSS ☐ Tudbidity Meter ☐ Other: —

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing ☑ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): clear; no odor

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes
		500mL Poly	1	—	

QC samples

Duplicate Sample No: — Duplicate Time: — MS/MSD: ☐ Yes ☑ No

Signature: TS Date: 3/24/22

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: POS - LLA Date of Collection: 3/23/22

Task: 8140 Field Personnel: AJ + TS

Purge Data

Well ID: MW-CP1 Secure: ☑ Yes ☐ No Ecology Tag #: _____ Casing Type/Diameter/Screened Interval _____

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#)____ Stripped (#)____ Other Damage: _____

Depth Sounder decontaminated Prior to Placement in Well: ☑ Yes ☐ No One Casing Volume (gal): _____

Depth of water (from TOC): 3.18 Time: 1357

Total Depth (from log or field measurement): _____

After 5 minutes of purging (from top of casing): 3.18

Begin purge (time): 1359 End purge (time): 1445

Volume purged: 3.5L Purge water disposal method ON-SITE drum

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
1410	3.20	1	6.70	9.23	196.6	0.70	9.7	159.5	
1415	3.20	1.5	6.67	8.19	195.7	0.96	9.3	161.7	
1420	3.20	2	6.67	7.76	200.7	0.99	9.6	155.7	

Sampling Data

Sample No: MW-CP1-032322 Location and Depth: _____

Date Collected (mo/dy/yr): 3/23/22 Time Collected: 1426 Weather: _____

Type: ☑ Ground Water ☐ Surface Water Other: _____ Sample: ☐ Filtered ☑ Unfiltered Filter Type: _____

Sample Collected with: ☐ Bailer ☑ Pump Other: _____ Type: ☐ Peristaltic ☐ Bladder ☐ Submersible Other: _____

Water Quality Instrument Data Collected with: Type: ☑ YSI ProDSS ☐ Tudbidity Meter ☐ Other: _____

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing ☑ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): _____

Sample Analyses

DUP: MW-CP1-032327-D @ 1430

Analyte	Analysis Method	Sample Container	Quantity	Preservati	Notes
		1/2L amber	4		
		1/2L poly	2		

QC samples

Duplicate Sample No: NA Duplicate Time: NA MS/MSD: ☐ Yes ☑ No

Signature: _____ Date: 3/23/22

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: PDS-WA Date of Collection: 3/23/22

Task: MWG Field Personnel: AS + TS

Purge Data

Well ID: MW-CP2 Secure: ☑ Yes ☐ No Ecology Tag #: ______ Casing Type/Diameter/Screened Interval ______

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) ____ Stripped (#) ____ Other Damage: ______

Depth Sounder decontaminated Prior to Placement in Well: ☑ Yes ☐ No One Casing Volume (gal): ______

Depth of water (from TOC): 3.81 Time: 1253

Total Depth (from log or field measurement): ______

After 5 minutes of purging (from top of casing): 3.70

Begin purge (time): 1255 End purge (time): 13:38

Volume purged: 3.5L Purge water disposal method on site drum

Volume of Schedule 40 PVC Pipe				
Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (L)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
1305	3.70	1	6.55	9.33	204.9	0.47	10.7	154.0	
1310	3.70	1.5	6.51	3.53	205.4	0.27	10.7	152.3	
1315	3.76	2	6.50	7.81	206.3	0.32	10.7	151.6	

Sampling Data

Sample No: MW-CP2-032322 Location and Depth: ______

Date Collected (mo/dy/yr): 3/23/22 Time Collected: 13:26 Weather: ______

Type: ☑ Ground Water ☐ Surface Water Other: ______ Sample: ☐ Filtered ☑ Unfiltered Filter Type: ______

Sample Collected with: ☐ Bailer ☑ Pump Other: ______ Type: ☑ Peristaltic ☐ Bladder ☐ Submersible Other. ______

Water Quality Instrument Data Collected with: Type: ☑ YSI ProDSS ☑ Tudbidity Meter ☐ Other: ______

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing ☑ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): Clear & no apparent odor

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes
		1/2 L amber	2		
		1/2 L poly	1		

QC samples

Duplicate Sample No: NA Duplicate Time: NA MS/MSD: ☐ Yes ☑ No

Signature: [signature] **Date:** 3/23/22

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: POS-LL Date of Collection: 3/23/22

Task: March GW Field Personnel: TS

Purge Data

Well ID: MW-CP3 Secure: ☒ Yes ☐ No Ecology Tag #: N/A Casing Type/Diameter/Screened Interval 2"

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) ____ Stripped (#) ____ Other Damage: —

Depth Sounder decontaminated Prior to Placement in Well: ☐ Yes ☐ No One Casing Volume (gal): ____

Depth of water (from TOC): 3.11' Time: 12:53

Total Depth (from log or field measurement): ____

After 5 minutes of purging (from top of casing): ~

Begin purge (time): 12:53 End purge (time): 13:36

Volume purged: 7L Purge water disposal method drum

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (L)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
13:00	3.11	1L	7.28	1.35	200.0	2.90	8.1	85.2	
13:05	3.11	3L	6.72	1.03	199.0	0.82	8.1	85.2	pump slowed
13:10	3.11	4.5	6.59	0.89	199.2	0.73	8.1	84.9	
13:15	3.11	5.5	6.54	0.83	199.5	0.83	8.1	84.8	
13:20	3.11	6.9	6.51	0.78	199.2	0.62	8.2	84.9	

Sampling Data

Sample No: MW-CP3-032322 Location and Depth: ____

Date Collected (mo/dy/yr): 03/23/22 Time Collected: 13:25 Weather: Rain ~50°F

Type: ☒ Ground Water ☐ Surface Water Other: — Sample: ☐ Filtered ☒ Unfiltered Filter Type: —

Sample Collected with: ☐ Bailer ☒ Pump Other: — Type: ☒ Peristaltic ☐ Bladder ☐ Submersible Other: —

Water Quality Instrument Data Collected with: Type: ☒ YSI ProDSS ☒ Tudbidity Meter ☐ Other: —

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing; ☒ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): clear; no odor

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes
		1 L Amber	2	—	
		500mL Poly	1	—	

QC samples

Duplicate Sample No: — Duplicate Time: — MS/MSD: ☐ Yes ☒ No

Signature: [signature] Date: 3/23/22

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: PGS - LLA Date of Collection: 3/23/22

Task: 8140 Field Personnel: AJ + TJ

Purge Data

Well ID: MW-CP4 Secure: ☑ Yes ☐ No Ecology Tag #: _____ Casing Type/Diameter/Screened Interval _____

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) ____ Stripped (#) ____ Other Damage: _____

Depth Sounder decontaminated Prior to Placement in Well: ☑ Yes ☐ No One Casing Volume (gal): _____

Depth of water (from TOC): 2.15 Time: 11:30

Total Depth (from log or field measurement): _____

After 5 minutes of purging (from top of casing): 2.15

Begin purge (time): 11:32 End purge (time): 12:18

Volume purged: 4.5L Purge water disposal method: on site drum

Volume of Schedule 40 PVC Pipe				
Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (L)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
11:40	2.15	1.5	6.71	9.09	184.1	0.73	10.1	181.5	
11:45	2.15	2	6.66	8.81	183.2	0.72	10.1	169.2	
11:50	2.15	2.5	6.60	8.21	182.2	0.79	10.1	163.0	
11:55	2.15	3	6.67	7.80	183.4	0.78	10.2	160.2	

Sampling Data

Sample No: MW-CP4-032322 Location and Depth: _____

Date Collected (mo/dy/yr): 3/23/22 Time Collected: 12:06 Weather: _____

Type: ☑ Ground Water ☐ Surface Water Other: _____ Sample: ☐ Filtered ☑ Unfiltered Filter Type: _____

Sample Collected with: ☐ Bailer ☑ Pump Other: _____ Type: ☑ Peristaltic ☐ Bladder ☐ Submersible Other: _____

Water Quality Instrument Data Collected with: Type: ☑ YSI ProDSS ☑ Tudbidity Meter ☐ Other: _____

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing ☑ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): clear w/ no apparent odor

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes
		1/2L amber	2		
		1/2L poly	1		

QC samples

Duplicate Sample No: NA Duplicate Time: NA MS/MSD: ☐ Yes ☑ No

Signature: _____ Date: 3/23/22

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: POS-LL Date of Collection: 3/23/22

Task: March GW Field Personnel: TS

Purge Data

Well ID: MW-CP5 Secure: ☒ Yes ☐ No Ecology Tag #: BLK315 Casing Type/Diameter/Screened Interval 2"

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) — Stripped (#) — Other Damage: —

Depth Sounder decontaminated Prior to Placement in Well: ☐ Yes ☐ No One Casing Volume (gal):

Depth of water (from TOC): 3.73' Time: 11:49

Total Depth (from log or field measurement):

After 5 minutes of purging (from top of casing): 4.00'

Begin purge (time): 11:49 End purge (time): 12:37

Volume purged: ~6L Purge water disposal method drum

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (L)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
12:00	3.94	2	6.53	1.01	421.2	2.53	9.9	90.2	
12:05	3.95	2.9	6.37	0.84	421.7	1.35	9.6	79.3	
12:10	3.95	3.75	6.32	0.77	423.7	0.86	9.8	71.9	
12:15	3.95	4.25	6.30	0.72	425.6	0.83	9.7	66.0	
12:20	3.95	5.0	6.28	0.69	429.4	0.74	9.6	61.5	

Sampling Data

Sample No: MW-CP5-032322 Location and Depth:

Date Collected (mo/dy/yr): 03/23/22 Time Collected: 12:25 Weather: ~~PC~~ Overcast ~60°F

Type: ☒ Ground Water ☐ Surface Water Other: — Sample: ☐ Filtered ☒ Unfiltered Filter Type: —

Sample Collected with: ☐ Bailer ☒ Pump Other: — Type: ☒ Peristaltic ☐ Bladder ☐ Submersible Other: —

Water Quality Instrument Data Collected with: Type: ☒ YSI ProDSS ☐ Tudbidity Meter ☐ Other:

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing ☒ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): Clear; no odor

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes
		1 L Amber	2	—	
		500mL Poly	1	—	

QC samples

Duplicate Sample No: — Duplicate Time: — MS/MSD: ☐ Yes ☒ No

Signature: Date: 3/23/22

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: POS-LL Date of Collection: 03/23/22

Task: March GW Field Personnel: TS

Purge Data

Well ID: MW-CP6 Secure: ☒ Yes ☐ No Ecology Tag #: BLK314 Casing Type/Diameter/Screened Interval: 2" Pressurized

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) — Stripped (#) — Other Damage: —

Depth Sounder decontaminated Prior to Placement in Well: ☒ Yes ☐ No One Casing Volume (gal): —

Depth of water (from TOC): 2.90 Time: 10:40

Total Depth (from log or field measurement): —

After 5 minutes of purging (from top of casing): 3.02'

Begin purge (time): 10:40 End purge (time): 11:25

Volume purged: 6.75 Purge water disposal method: drum

Volume of Schedule 40 PVC Pipe				
Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (L)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
10:50	2.95	2	6.77	1.20	199.6	6.63	11.6	133.5	
10:55	2.95	2.9	6.56	0.95	198.6	4.24	11.5	121.9	
11:00	2.96	3.75	6.43	0.83	198.1	3.14	11.4	114.1	
11:05	2.96	4.9	6.37	0.77	197.9	3.04	11.4	108.2	
11:10	2.96	5.5	6.32	0.73	198.0	3.26	11.4	105.2	

Sampling Data

Sample No: MW-CP6-032322 Location and Depth: —

Date Collected (mo/dy/yr): 03/23/22 Time Collected: 11:15 Weather: Cloudy ~55°F

Type: ☒ Ground Water ☐ Surface Water Other: — Sample: ☐ Filtered ☒ Unfiltered Filter Type: —

Sample Collected with: ☐ Bailer ☒ Pump Other: — Type: ☒ Peristaltic ☐ Bladder ☐ Submersible Other: —

Water Quality Instrument Data Collected with. Type: ☒ YSI ProDSS ☒ Tudbidity Meter ☐ Other: —

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing; ☒ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): Slight odor; orange flock in sample

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes
		1L Amber	2	—	Cap under pressure
		500mL Poly	1	~	

QC samples

Duplicate Sample No: — Duplicate Time: ~ MS/MSD: ☐ Yes ☒ No

Signature: [signature] Date: 03/23/22

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: PDS-UA Date of Collection: 3/23/22

Task: 8140 Field Personnel: AS + TS

Purge Data

Well ID: MW-CP7 Secure: ☑ Yes ☐ No Ecology Tag #: _____ Casing Type/Diameter/Screened Interval _____

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) ____ Stripped (#) ____ Other Damage: _____

Depth Sounder decontaminated Prior to Placement in Well: ☑ Yes ☐ No One Casing Volume (gal): _____

Depth of water (from TOC): 4.20 Time: 10:28

Total Depth (from log or field measurement): _____

After 5 minutes of purging (from top of casing): 4.30

Begin purge (time): 10:30 End purge (time): 11:20

Volume purged: 4 L Purge water disposal method: onsite drum

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (L)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
10:40	4.30	1	6.20	9.81	231.9	0.54	11.6	174.8	
10:45	4.30	1.5	6.13	9.60	231.8	0.59	11.7	177.2	
10:50	4.30	2	6.14	8.45	231.6	0.66	11.6	177.9	
10:55	4.30	2.5	6.14	7.95	231.4	0.45	11.6	179.1	

Sampling Data

Sample No: MW-CP7-032322 Location and Depth: _____

Date Collected (mo/dy/yr): 3/23/22 Time Collected: 11:00 Weather: _____

Type: ☐ Ground Water ☐ Surface Water Other: _____ Sample: ☐ Filtered ☑ Unfiltered Filter Type: _____

Sample Collected with: ☐ Bailer ☑ Pump Other: _____ Type: ☐ Peristaltic ☐ Bladder ☐ Submersible Other: _____

Water Quality Instrument Data Collected with: Type: ☑ YSI ProDSS ☑ Tudbidity Meter ☐ Other: _____

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing ☐ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): Clear, no apparent odor

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes
		1/2L amber	2	None	
		1/2L poly	1		

QC samples

Duplicate Sample No: None Duplicate Time: NA MS/MSD: ☐ Yes ☑ No

Signature: _____ Date: 3/23/22

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: POS-CLA | Date of Collection: 3/24/22

Task: 8140 | Field Personnel: AS & TS

Purge Data

Well ID: MW-VB2 | Secure: ☑ Yes ☐ No | Ecology Tag #: BKA-240 | Casing Type/Diameter/Screened Interval: 2"

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) ~ Stripped (#) ~ | Other Damage: ~

Depth Sounder decontaminated Prior to Placement in Well: ☑ Yes ☐ No | One Casing Volume (gal):

Depth of water (from TOC): 8.60 | Time: 9:44

Total Depth (from log or field measurement):

After 5 minutes of purging (from top of casing): 8.123

Begin purge (time): 9:45 | End purge (time): 10:25

Volume purged: | Purge water disposal method: drum

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (L)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
10:00	8.63	4.5	6.55	2.83	236.0	1.08	10.1	116.0	
10:05	8.63	5.5	6.53	2.100	237.9	0.77	10.1	111.1	
10:10	8.63	7	6.50	2.46	231.3	1.46	10.1	106.3	

Sampling Data

Sample No: MW-VB2-032422 | Location and Depth:

Date Collected (mo/dy/yr): 03/24/22 | Time Collected: 10:30 | Weather:

Type: ☑ Ground Water ☐ Surface Water Other: ~ | Sample: ☐ Filtered ☑ Unfiltered Filter Type: ~

Sample Collected with: ☐ Bailer ☑ Pump Other: ~ | Type: ☑ Peristaltic ☐ Bladder ☐ Submersible Other: ~

Water Quality Instrument Data Collected with: Type: ☑ YSI ProDSS ☑ Tudbidity Meter ☐ Other: ~

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing; ☑ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): clear; no odor

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes
		1L Amber	2	~	
		500mL Poly	1	~	

QC samples

Duplicate Sample No: ~ | Duplicate Time: ~ | MS/MSD: ☐ Yes ☒ No

Signature: | Date: 3/24/22

GROUNDWATER OR SURFACE WATER SAMPLE COLLECTION FORM

Project: POJ-LLA Date of Collection: 3/23/22

Task: 9140 Field Personnel: AJ + TS

Purge Data

Well ID: MW-VB3 Secure: ☑ Yes ☐ No Ecology Tag #: _____ Casing Type/Diameter/Screened Interval _____

Replacement Required: ☐ Monument ☐ Lid ☐ Lock ☐ Bolts: Missing (#) ____ Stripped (#) ____ Other Damage: _____

Depth Sounder decontaminated Prior to Placement in Well: ☑ Yes ☐ No One Casing Volume (gal): _____

Depth of water (from TOC): 7.96 Time: 9:00

Total Depth (from log or field measurement): _____

After 5 minutes of purging (from top of casing): _____

Begin purge (time): 9:03 End purge (time): 9:52

Volume purged: 4.5L Purge water disposal method: on site drum

Volume of Schedule 40 PVC Pipe

Diameter	O.D.	I.D.	Volume (Gal/Linear Ft.)	Weight of Water (Lbs/Lineal Ft.)
1 ¼"	1.660"	1.380"	0.08	0.64
2"	2.375"	2.067"	0.17	1.45
3"	3.500"	3.068"	0.38	3.2
4"	4.500"	4.026"	0.66	5.51
6"	6.625"	6.065"	1.5	12.5

Time	Depth to Water (ft)	Vol. Purged (L)	pH (s.u.)	DO (mg/L)	Specific Conductivity (µs/cm)	Turbidity (NTU)	Temp (°C)	ORP (mV)	Comments
9:15	9.99	2	5.77	9.62	293.1	0.27	11.6	197.9	
9:20	9.99	2.5	5.79	9.05	289.1	0.42	11.6	198.3	
9:25	9.99	3	5.82	8.40	287.7	0.52	11.7	191.8	

Sampling Data

Sample No: MW-VB3-032322 Location and Depth: _____

Date Collected (mo/dy/yr): 3/23/22 Time Collected: 9:36 Weather: _____

Type: ☑ Ground Water ☐ Surface Water Other: _____ Sample: ☐ Filtered ☑ Unfiltered Filter Type: _____

Sample Collected with: ☐ Bailer ☐ Pump Other: _____ Type: ☑ Peristaltic ☐ Bladder ☐ Submersible Other: _____

Water Quality Instrument Data Collected with: Type: ☑ YSI ProDSS ☑ Tudbidity Meter ☐ Other: _____

Sample Decon Procedure: Sample collected with: ☐ decontaminated all tubing; ☐ disposable tubing ☑ dedicated silicon and poly tubing; ☐ dedicated tubing replaced

Sample Description (Color, Turbidity, Odor, Other): clear, no apparent odor

Sample Analyses

Analyte	Analysis Method	Sample Container	Quantity	Preservative	Notes
		1/2 L amber	2	None	
		1/2 L poly	1		

QC samples

Duplicate Sample No: NA Duplicate Time: NA MS/MSD: ☐ Yes ☑ No

Signature: _____ **Date:** _____

Lora Lake Apartments Site

2022 Annual Compliance Monitoring Report

Appendix B
Laboratory Reports and Data Validation Summaries

FLOYD | SNIDER
strategy ▪ science ▪ engineering

Two Union Square
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Data Validation Summary

Prepared by: Gretchen Heavner
Date: November 1, 2022
Project No.: POS-LLA
Sample Event(s): March 2022 Groundwater Monitoring
Sample Delivery Group(s): ARI22C0456
Sample Media: Groundwater

A Compliance Screening (Stages 1 & 2A) data quality review was performed on metals data resulting from laboratory analysis. The analytical data were validated in accordance with the *National Functional Guidelines for Inorganic Superfund Methods Data Review* (USEPA 2020a). Dixon/Furans were validated externally by EcoChem, please refer to the data validation report in Appendix B for details.

A total of fifteen groundwater samples were submitted in one sample delivery group, ARI22C0456, to Analytical Resources, Inc. for chemical analysis. The analytical holding times were met and the method blank had no detections. The matrix spike and laboratory control sample recoveries and sample/sample duplicate relative percent differences all met U.S. Environmental Protection Agency (USEPA) requirements.

No qualifiers were added to the analytical results based on the data quality review. Data are determined to be of acceptable quality for use as reported by the laboratory, with some laboratory qualifiers being updated to conform to the final qualifiers used for data table reporting and database storage.

REFERENCES

U.S. Environmental Protection Agency (USEPA). 2020a. *National Functional Guidelines for Inorganic Superfund Methods Data Review.* Prepared by the Office of Superfund Remediation and Technology Innovation. EPA-542-R-20-006/OLEM 9240.1-66. November.

DATA VALIDATION REPORT

LORA LAKE - ANNUAL LAKESIDE GW MONITORING 2022

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June 1, 2022

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PROJECT NARRATIVE

Basis for the Data Validation

This report summarizes the results of data validation performed on groundwater and quality control (QC) sample data for the Lora Lake Lakeside GW Monitoring project. The dioxin data received full validation (EPA Stage 4). A complete list of samples is provided in the Sample Index.

Analytical Resources in Tukwila, WA performed the analyses. The analytical method and EcoChem project chemists are listed in the table below.

ANALYSIS	METHOD	PRIMARY REVIEW	SECONDARY REVIEW
Dioxins	EPA 1613B	A. Bodkin	C. Ransom

The data were reviewed using guidance and quality control criteria documented in the analytical methods; *Port of Seattle Lora Lake Parcel, Remedial Investigation/Feasibility Study Work Plan* (Floyd Snider February 11, 2011); *National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review* (USEPA, September 2011); *National Functional Guidelines for High Resolution Superfund Methods Data Review* (USEPA, April 2016).

EcoChem's goal in assigning data assessment qualifiers is to assist in proper data interpretation. If values are estimated (J or UJ), data may be used for site evaluation and risk assessment purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. If values are assigned an R or DNR, the data should not be used for any site evaluation purposes. If values have no data qualifier assigned, then the data meet the data quality objectives as stated in the documents and methods referenced above.

Data qualifier definitions, reason codes, and validation criteria are included as Appendix A. A Qualified Data Summary Table is included in Appendix B. Data Validation Worksheets will be kept on file at EcoChem, Inc. A qualified laboratory electronic data deliverable (EDD) is also submitted with this report.

Sample Index
Lora Lake - Annual Lakeside GW Monitoring 2022

SDG	SAMPLE ID	LAB ID	1613B Dioxins
22C0456	MW-CP1-032322	22C0456-01	✓
22C0456	MW-CP1-032322-D	22C0456-02	✓
22C0456	MW-CP2-032322	22C0456-03	✓
22C0456	MW-CP3-032322	22C0456-04	✓
22C0456	MW-CP4-032322	22C0456-05	✓
22C0456	MW-CP5-032322	22C0456-06	✓
22C0456	MW-CP6-032322	22C0456-07	✓
22C0456	MW-CP7-032322	22C0456-08	✓
22C0456	MW-VB3-032322	22C0456-09	✓
22C0456	HCOO-B312-032322	22C0456-10	✓
22C0456	MW-C1-VB1-032422	22C0456-11	✓
22C0456	MW-C1-VB1-032422-D	22C0456-12	✓
22C0456	MW-VB2-032422	22C0456-15	✓

DATA VALIDATION REPORT
Lora Lake - Annual Lakeside GW Monitoring 2022
Dioxin/Furan Compounds by Method 1613B

This report documents the review of analytical data from the analysis of groundwater samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. Refer to the SAMPLE INDEX for a complete list of samples.

SDG	NUMBER OF SAMPLES	VALIDATION LEVEL
22C0456	13 Groundwater	EPA Stage 4

DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

EDD TO HARDCOPY VERIFICATION

Sample results and related quality control data were received as an electronic data deliverable (EDD) and laboratory report. The EDD was verified against the laboratory report (10%). No errors were noted.

For laboratory sample 22C0546-15, the sample ID of MW-C1-VB-1-032422 did not match the ID of MW-VB2-032422 on the Chain-of-Custody (COC). The ID was corrected in the EDD during validation; no further action was taken.

TECHNICAL DATA VALIDATION

The quality control (QC) requirements reviewed are summarized in the following table:

✓	Sample Receipt, Preservation, and Holding Times	✓	Ongoing Precision and Recovery (OPR)
✓	System Performance and Resolution Checks	1	Field Duplicates
✓	Initial Calibration (ICAL)	✓	Target Analyte List
✓	Calibration Verification	✓	Reported Results
2	Blanks (Laboratory and Field)	2	Compound Identification
✓	Labeled Compounds	1	Calculation Verification

✓ ***Stated method quality objectives (MQO) and QC criteria have been met. No outliers are noted or discussed.***
1 ***Quality control results are discussed below, but no data were qualified.***
2 ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Blanks

To assess the impact of any blank contaminant on the reported sample results, an action level is established at five times (5x) the concentration reported in the blank. If a contaminant is reported

in an associated field sample and the concentration is less than the action level, the result is qualified as not detected (U-7). No action is taken if the sample result is greater than the action level, or for non-detected results.

OCDD was detected in the method blank. Results for this compound in the associated samples that were less than the 5x action level were qualified as not-detected (U-7).

No field blanks were submitted.

Field Duplicates

The RPD control limit is 35% for results greater than 5x the reporting limit (RL). For results less than 5x the RL, the absolute difference between the sample and replicate must be less than the RL.

Two sets of field duplicates were submitted: MW-CP1-032322 & MW-CP1-032322-D and MW-C1-VB1-032422 &. MW-C1-VB1-032422-D. Field precision was acceptable.

Compound Identification

The method requires the confirmation of 2,3,7,8-TCDF using an alternate GC column as the DB5 column that is typically used cannot fully separate 2,3,7,8-TCDF from closely eluting non-target TCDF isomers. The laboratory uses an RTX-Dioxin2 column which provides adequate resolution of the TCDF isomers as indicated by the acceptable peak to valley ratios. Since the 2,3,7,8-TCDF resolution was acceptable, no confirmation was necessary.

The laboratory assigned an "EMPC" flag (NUJ-flag in the EDD) to indicate that the ion ratio criterion for positive identification was not met. Since the ion abundance ratio is the primary identification criterion for high resolution mass spectroscopy, an outlier indicates that the reported result may be a false positive. These “EMPC” flagged results were qualified as not detected (U-25) at the reported concentration.

Calculation Verification

Several results were verified by recalculation from the raw data. No calculation or transcription errors were found.

OVERALL ASSESSMENT

As determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the labeled compound and OPR/OPR Dup recoveries and precision was acceptable as demonstrated by the OPR/OPR Dup and field duplicate RPD values.

Detection limits were elevated based on ion ratio outliers and method blank contamination.

All data, as qualified, are acceptable for use.

ECOCHEM
Data Quality

APPENDIX A

DATA QUALIFIER DEFINITIONS
REASON CODES
AND CRITERIA TABLES

DATA VALIDATION QUALIFIER CODES
Based on National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents the approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

Group	Code	Reason for Qualification
Sample Handling	1	Improper Sample Handling or Sample Preservation (i.e., headspace, cooler temperature, pH, summa canister pressure); Exceeded Holding Times
Instrument Performance	24	Instrument Performance (i.e., tune, resolution, retention time window, endrin breakdown, lock-mass)
	5A	Initial Calibration (RF, %RSD, r^2)
	5B	Calibration Verification (CCV, CCAL; RF, %D, %R) Use bias flags (H,L)[1] where appropriate
	5C	Initial Calibration Verification (ICV %D, %R) Use bias flags (H,L)[1] where appropriate
Blank Contamination	6	Field Blank Contamination (Equipment Rinsate, Trip Blank, etc.)
	7	Lab Blank Contamination (i.e., method blank, instrument blank, etc.) Use low bias flag (L)[1] for negative instrument blanks
Precision and Accuracy	8	Matrix Spike (MS and/or MSD) Recoveries Use bias flags (H,L)[1] where appropriate
	9	Precision (all replicates: LCS/LCSD, MS/MSD, Lab Replicate, Field Replicate)
	10	Laboratory Control Sample Recoveries (a.k.a. Blank Spikes) Use bias flags (H,L)[1] where appropriate
	12	Reference Material Use bias flags (H,L)[1] where appropriate
	13	Surrogate Spike Recoveries (a.k.a. labeled compounds, recovery standards) Use bias flags (H,L)[1] where appropriate
Interferences	16	ICP/ICP-MS Serial Dilution Percent Difference
	17	ICP/ICP-MS Interference Check Standard Recovery Use bias flags (H,L)[1] where appropriate
	19	Internal Standard Performance (i.e., area, retention time, recovery)
	22	Elevated Detection Limit due to Interference (i.e., chemical and/or matrix)
	23	Bias from Matrix Interference (i.e. diphenyl ether, PCB/pesticides)
Identification and Quantitation	2	Chromatographic pattern in sample does not match pattern of calibration standard
	3	2nd column confirmation (RPD or %D)
	4	Tentatively Identified Compound (TIC) (associated with NJ only)
	20	Calibration Range or Linear Range Exceeded
	25	Compound Identification (i.e., ion ratio, retention time, relative abundance, etc.)
Miscellaneous	11	A more appropriate result is reported (multiple reported analyses i.e., dilutions, re-extractions, etc. Associated with "R" and "DNR" only)
	14	Other (See DV report for details)
	26	Method QC information not provided

[1] H = high bias indicated
L = low bias indicated

DATA QUALIFIER REASON CODES

Group	Code	Reason for Qualification
Sample Handling	1	Improper Sample Handling or Sample Preservation (i.e., headspace, cooler temperature, pH, summa canister pressure); Exceeded Holding Times
Instrument Performance	24	Instrument Performance (i.e., tune, resolution, retention time window, endrin breakdown, lock-mass)
	5A	Initial Calibration (RF, %RSD, r^2)
	5B	Calibration Verification (CCV, CCAL; RF, %D, %R) Use bias flags (H,L)[1] where appropriate
	5C	Initial Calibration Verification (ICV %D, %R) Use bias flags (H,L)[1] where appropriate
Blank Contamination	6	Field Blank Contamination (Equipment Rinsate, Trip Blank, etc.)
	7	Lab Blank Contamination (i.e., method blank, instrument blank, etc.) Use low bias flag (L)[1] for negative instrument blanks
Precision and Accuracy	8	Matrix Spike (MS and/or MSD) Recoveries Use bias flags (H,L)[1] where appropriate
	9	Precision (all replicates: LCS/LCSD, MS/MSD, Lab Replicate, Field Replicate)
	10	Laboratory Control Sample Recoveries (a.k.a. Blank Spikes) Use bias flags (H,L)[1] where appropriate
	12	Reference Material Use bias flags (H,L)[1] where appropriate
	13	Surrogate Spike Recoveries (a.k.a. labeled compounds, recovery standards) Use bias flags (H,L)[1] where appropriate
Interferences	16	ICP/ICP-MS Serial Dilution Percent Difference
	17	ICP/ICP-MS Interference Check Standard Recovery Use bias flags (H,L)[1] where appropriate
	19	Internal Standard Performance (i.e., area, retention time, recovery)
	22	Elevated Detection Limit due to Interference (i.e., chemical and/or matrix)
	23	Bias from Matrix Interference (i.e. diphenyl ether, PCB/pesticides)
Identification and Quantitation	2	Chromatographic pattern in sample does not match pattern of calibration standard
	3	2nd column confirmation (RPD or %D)
	4	Tentatively Identified Compound (TIC) (associated with NJ only)
	20	Calibration Range or Linear Range Exceeded
	25	Compound Identification (i.e., ion ratio, retention time, relative abundance, etc.)
Miscellaneous	11	A more appropriate result is reported (multiple reported analyses i.e., dilutions, re-extractions, etc. Associated with "R" and "DNR" only)
	14	Other (See DV report for details)
	26	Method QC information not provided

[1] H = high bias indicated
L = low bias indicated

Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2011 and Methods EPA 1613B and SW-846 8290)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Sample Handling					
Cooler/Storage Temperature Preservation	Waters/Solids ≤ 6°C & in the dark Tissues <-10°C & in the dark **Preservation Aqueous:** If Cl_2 is present Thiosulfate must be added and if pH > 9 it must be adjusted to 7 - 9	NFG [1] Method[2]	J(pos)/R(ND) if thiosulfate not added if Cl_2 present; J(pos)/UJ(ND) if pH not adjusted J(pos)/UJ(ND) if temp > 20°C	1	**EcoChem PJ, see TM-05**
Holding Time	**If properly stored, 1 year or:** **Extraction (all matrices):** 30 days from collection **Analysis (all matrices)**: 45 days from extraction	NFG [1] Method[2]	If not properly stored or HT exceedance: J(pos)/UJ(ND)	1	**EcoChem PJ, see TM-05** Gross exceedance = > 1 year 2011 NFG **Note:** Under CWA, SDWA, and RCRA the HT for H2O is 7 days.
Instrument Performance					
Mass Resolution (Tuning)	PFK (Perfluorokerosene) ≥10,000 resolving power at m/z 304.9824. Exact mass of m/z 380.9760 w/in 5 ppm of theoretical value (380.97410 to 380.97790) . Analyzed prior to ICAL and at the start and end of each 12 hr. shift.	NFG [1] Method [2]	R(pos/ND) all analytes in all samples associated with the tune	24	Notify PM
Windows Defining Mix	Peaks for first and last eluters must be within established retention time windows for each selector group (chlorination level)	NFG [1] Method [2]	If peaks are not completely within windows (clipped): If natives are ok, J(pos)/UJ(ND) homologs (Totals) If natives are affected, R all results for that selector group	24	Notify PM
Column Performance Mix	Both mixes must be analyzed before ICAL and CCAL Valley < 25% (valley = (x/y)*100%) where x = ht. of TCDD (or TCDF) & y = baseline to bottom of valley For all isomers eluting near the 2378-TCDD (TCDF) peak (TCDD only for 8290)	NFG [1] Method [2]	J(pos) if valley > 25%	24	**EcoChem PJ, see TM-05, Rev. 2**; Note: TCDF is evaluated only if second column confirmation is performed
Initial Calibration **Sensitivity**	S/N ratio > 10 for all native and labeled compounds in CS1 std.	NFG [1] Method [2]	If <10, elevate Det. Limit or R(ND)	5A	
Initial Calibration **Selectivity**	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	NFG [1] Method [2]	If 2 or more ion ratios are out for one compound in ICAL, J(pos)	5A	**EcoChem PJ, see TM-05, Rev. 2**

Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2011 and Methods EPA 1613B and SW-846 8290)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Instrument Performance (continued)					
Initial Calibration (Minimum 5 stds.) **Stability**	%RSD < 20% for native compounds %RSD <30% for labeled compounds (%RSD < 35% for labeled compounds under 1613b)	NFG [1] Method [2]	J(pos) natives if %RSD > 20%	5A	
	Absolute RT of $^{13}C_{12}$-1234-TCDD >25 min on DB5 & >15 min on DB-225	NFG [1] Method [2]	Narrate, no action		**EcoChem PJ, see TM-05, Rev. 2**
Continuing Calibration (Prior to each 12 hr. shift) **Sensitivity**	S/N ratio for CS3 standard > 10	NFG [1] Method [2]	If <10, elevate Det. Limit or R(ND)	5B	
Continuing Calibration (Prior to each 12 hr. shift) **Selectivity**	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	NFG [1] Method [2]	For congener with ion ratio outlier, J(pos) natives in all samples associated with CCAL. No action for labeled congener ion ratio outliers.	25	**EcoChem PJ, see TM-05**
Continuing Calibration (Prior to each 12 hr. shift) **Stability**	%D+/-20% for native compounds %D +/-30% for labeled compounds **(Must meet limits in Table 6, Method 1613B)** If %D in the closing CCAL are within 25%/35%, the mean RF from the two CCAL may be used to calculate samples **(Section 8.3.2.4 of 8290)**.	NFG [1] Method [2]	**Labeled compounds:** Narrate, no action. **Native compounds:** 1613: J(pos)/UJ(ND)if %D is outside Table 6 limits J(pos)/R(ND) if %D is +/-75% of Table 6 limits 8290: J(pos)/UJ(ND) if %D = 20% - 75% J(pos)/R(ND) if %D > 75%	5B (H,L)[3]	
	Absolute RT of $^{13}C_{12}$-1234-TCDD and $^{13}C_{12}$-123789-HxCDD should be ± 15 seconds of ICAL RRT for all other compounds must meet criteria listed in Table 2 Method 1316.	NFG [1] Method [2]	Narrate, no action	5B	**EcoChem PJ, see TM-05**
Blank Contamination					
Method Blank (MB)	MB: One per matrix per batch of (of ≤ 20 samples) No detected compounds > RL	NFG [1] Method [2]	U(pos) if result is < 5X action level.	7	**Hierarchy of blank review:** **#1 - Review MB, qualify as needed** **#2 - Review FB , qualify as needed**
Field Blank (FB)	FB: frequency as per QAPP No detected compounds > RL		U(pos) if result is < 5X action level.	6	

Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2011 and Methods EPA 1613B and SW-846 8290)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Precision and Accuracy					
MS/MSD (recovery)	**MS/MSD not typically required for HRMS analyses.** If lab analyzes MS/MSD then one set per matrix per batch (of ≤ 20 samples) Use most current laboratory control limits	EcoChem standard policy	J(pos) if both %R > UCL - high bias J(pos)/UJ(ND) if both %R < LCL - low bias J(pos)/R(ND) if both %R < 10% - very low bias J(pos)/UJ(ND) if one > UCL & one < LCL, with no bias **PJ if only one %R outlier**	8 (H,L)[3]	No action if only one spike %R is outside criteria. No action if parent concentration is >4x the amount spiked. Qualify parent sample only unless other QC indicates systematic problems.
MS/MSD (RPD)	**MS/MSD not typically required for HRMS analyses.** If lab analyzes MS/MSD then one set per matrix per batch (of ≤ 20 samples) Use most current laboratory control limits	EcoChem standard policy	J(pos) in parent sample if RPD > CL	9	Qualify parent sample only.
LCS (or OPR)	One per lab batch (of ≤ 20 samples) Use most current laboratory control limits **or** Limits from Table 6 of 1613B	NFG [1] Method [2]	J(pos) if %R > UCL - high bias J(pos)/UJ(ND) if %R < LCL - low bias J(pos)/R(ND) if %R < 10% - very low bias	10 (H,L)[3]	No action if only one spike %R is outside criteria, when LCSD is analyzed. Qualify all associated samples.
LCS/LCSD (RPD)	**LCSD not typically required for HRMS analyses.** One set per matrix and batch of 20 samples RPD < 35%	Method [2] Ecochem standard policy	J(pos) assoc. compound in all samples if RPD > CL	9	Qualify all associated samples.
Lab Duplicate (RPD)	**Lab Dup not typically required for HRMS analyses.** One per lab batch (of ≤ 20 samples) Use most current laboratory control limits	EcoChem standard policy	J(pos)/UJ(ND) if RPD > CL	9	
Labeled Compounds (Internal Standards)	Added to all samples %R = 40% - 135% in all samples 8290 %R must meet limits in Table 7 Method 1613B	NFG [1] Method [2]	J(pos) if %R > UCL - high bias J(pos)/UJ(ND) if %R < LCL - low bias J(pos)/R(ND) if %R < 10% - very low bias	13 (H,L)[3]	
Field Duplicates	Solids: RPD <50% OR difference < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR difference < 1X RL (for results < 5X RL)	EcoChem standard policy	Narrate and qualify if required by project	9	**Use professional judgment**

Dioxin/Furan Analysis by HRMS
(Based on Dioxin NFG 2011 and Methods EPA 1613B and SW-846 8290)

QC Element	Acceptance Criteria	Source of Criteria	Action for Non-Conformance	Reason Code	Discussion and Comments
Compound ID and Calculation					
Quantitation/ Identification	All ions for each isomer must maximize within ± 2 seconds. S/N ratio >2.5 Ion ratios must meet criteria listed in Table 8 Method 8290, or Table 9 of 1613B; RRTs w/in limits in Table 2 of 1613B	NFG [1] Method [2]	Narrate in report; qualify if necessary NJ(pos) for retention time outliers. U(pos) for ion ratio outliers.	25	**EcoChem PJ, see TM-05**
EMPC (estimated maximum possible concentration)	If quantitation identification criteria are not met, laboratory should report an EMPC value.	NFG [1] Method [2]	If laboratory correctly reported an EMPC value, qualify the native compound U(pos) to indicate that the value is a detection limit and qualify total homolog groups J (pos)	25	**Use professional judgment See TM-18**
Interferences	Interferences from chlorodiphenyl ether compounds	NFG [1] Method [2]	J(pos)/UJ(ND) if present	23	**See TM-16**
	Lock masses must not deviate ± 20% from values in Table 8 of 1613B	Method [2]	J(pos)/UJ(ND) if present	24	**See TM-17**
Second Column Confirmation	All 2,3,7,8-TCDF hits must be confirmed on a DB-225 (or equiv) column. All QC criteria must also be met for the confirmation analysis.	NFG [1] Method [2]	Report the DB-225 value. If not performed use PJ.	3	DNR-11 DB5 result if both results from both columns are reported. **EcoChem PJ, see TM-05**
Calculation Check	Check 10% of field & QC sample results	EcoChem standard policy	Contact laboratory for resolution and/or corrective action	na	Full data validation only.
Electronic Data Deliverable (EDD)					
Verification of EDD to hardcopy data	EcoChem verify @ 10% unless problems noted; then increase level up to 100% for next several packages.		Depending on scope of problem, correct at EcoChem (minor issues) to resubmittal by laboratory (major issues).	na	EcoChem Project Manager and/or Database Administrator will work with lab to provide long-term corrective action.
Dilutions, Re-extractions and/or Reanalyses	Report only one result per analyte	Standard reporting policy	Use "DNR" to flag results that will not be reported.	11	

(pos) - positive (detected) results; (ND) - not detected results

[1] National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) & Chlorinated Dibenzofurans (CDFs) Data Review, September 2011

[2] Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry (HRGC/HRMS), USEPA SW-846, Method 8290

[2] EPA Method 1613, Rev.B, Tetra-through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGS/HRMS, October 1994

[3] NFG 2013 suggests using "+ / -" to indicate bias; EcoChem has chosen "H" = high bias indicated; "L" = low bias indicated.

ECOCHEM
Data Quality

APPENDIX B

QUALIFIED DATA SUMMARY TABLE

Qualified Data Summary Table
Lora Lake - Annual Lakeside GW Monitoring 2022

SAMPLE ID	LAB ID	METHOD	ANALYTE	RESULT	UNITS	LAB QUAL	DV QUAL	DV CODE
MW-CP1-032322	22C0456-01	EPA1613B	OCDD	17.3	pg/L	J,B	U	7
MW-CP1-032322-D	22C0456-02	EPA1613B	1,2,3,4,6,7,8-HpCDD	3.19	pg/L	NUJ,J	U	25
MW-CP1-032322-D	22C0456-02	EPA1613B	1,2,3,4,7,8-HxCDD	1.44	pg/L	NUJ,J	U	25
MW-CP1-032322-D	22C0456-02	EPA1613B	1,2,3,4,7,8-HxCDF	1.85	pg/L	NUJ,J	U	25
MW-CP1-032322-D	22C0456-02	EPA1613B	1,2,3,7,8-PeCDF	1.60	pg/L	NUJ,J	U	25
MW-CP1-032322-D	22C0456-02	EPA1613B	2,3,4,6,7,8-HxCDF	0.99	pg/L	NUJ,J	U	25
MW-CP1-032322-D	22C0456-02	EPA1613B	OCDD	15.7	pg/L	J,B	U	7
MW-CP3-032322	22C0456-04	EPA1613B	1,2,3,7,8,9-HxCDD	1.24	pg/L	NUJ,J	U	25
MW-CP4-032322	22C0456-05	EPA1613B	OCDD	5.33	pg/L	NUJ,J,B	U	25
MW-CP5-032322	22C0456-06	EPA1613B	OCDD	4.65	pg/L	J,B	U	7
MW-CP6-032322	22C0456-07	EPA1613B	OCDD	34.6	pg/L	J,B	U	7
MW-CP7-032322	22C0456-08	EPA1613B	1,2,3,7,8-PeCDF	1.15	pg/L	NUJ,J	U	25
MW-CP7-032322	22C0456-08	EPA1613B	OCDD	3.28	pg/L	NUJ,J,B	U	25
MW-VB3-032322	22C0456-09	EPA1613B	1,2,3,4,6,7,8-HpCDD	3.18	pg/L	NUJ,J	U	25
MW-VB3-032322	22C0456-09	EPA1613B	1,2,3,4,6,7,8-HpCDF	2.17	pg/L	NUJ,J	U	25
MW-VB3-032322	22C0456-09	EPA1613B	OCDD	23.9	pg/L	J,B	U	7
HCOO-B312-032322	22C0456-10	EPA1613B	1,2,3,6,7,8-HxCDF	0.97	pg/L	NUJ,J	U	25
HCOO-B312-032322	22C0456-10	EPA1613B	2,3,4,7,8-PeCDF	1.70	pg/L	NUJ,J	U	25
HCOO-B312-032322	22C0456-10	EPA1613B	OCDD	23.3	pg/L	NUJ,J,B	U	25
MW-C1-VB1-032422	22C0456-11	EPA1613B	OCDD	3.18	pg/L	NUJ,J,B	U	25
MW-C1-VB1-032422-D	22C0456-12	EPA1613B	1,2,3,4,6,7,8-HpCDD	2.91	pg/L	NUJ,J	U	25
MW-C1-VB1-032422-D	22C0456-12	EPA1613B	2,3,4,7,8-PeCDF	0.88	pg/L	NUJ,J	U	25
MW-C1-VB1-032422-D	22C0456-12	EPA1613B	OCDD	5.59	pg/L	NUJ,J,B	U	25
MW-VB2-032422	22C0456-15	EPA1613B	OCDD	8.71	pg/L	J,B	U	7

Analytical Resources, LLC
Analytical Chemists and Consultants

15 April 2022

Amanda McKay
Floyd - Snider
601 Union Street Two Union Square, Suite 600
Seattle, WA 98101-2341

RE: Lora Lake 2021-2023 sec II. 5.3.21

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

Associated Work Order(s)	Associated SDG ID(s)
22C0456	N/A

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclosed Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the requirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, LLC

Kelly Bottem, Client Services Manager

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

ACCREDITED IN ACCORDANCE WITH nelac
Cert# 100006-012

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 22C0456	Turn-around Requested:
ARI Client Company: Floyd|Snider Phone: 206-292-2078	
Client Contact: Amanda McKay	
Client Project Name: POS-LCA	
Client Project #:	Samplers: A. Jumper & T. Scott

Page: 1 of 2	
Date: 3/23/22	Ice Present?
No. of Coolers:	Cooler Temps: 4.6; 0.5; 1.9

Analytical Resources, LLC
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: Dissolved As	Analysis Requested: Dioxins Furans	Notes/Comments
MW-CP1-032322	3/23/22	1426	gw	3	X	X	As sample to be lab filtered
MW-CP1-032322-D	3/23/22	1436	gw	3	X	X	
MW-CP2-032322	3/23/22	13:26	gw	3	X	X	
MW-CP3-032322	3/23/22	13:25	gw	3	X	X	
MW-CP4-032322	3/23/22	12:06	gw	3	X	X	
MW-CP5-032322	3/23/22	12:25	gw	3	X	X	
MW-CP6-032322	3/23/22	11:15	gw	3	X	X	
MW-CP7-032322	3/23/22	11:06	gw	3	X	X	
MW-VB3-032322	3/23/22	9:36	gw	3	X	X	
HCOD-B312-032322	3/23/22	15:00	gw	3	X	X	

Comments/Special Instructions	Relinquished by: (Signature)	Printed Name:	Company:	Date & Time:	Received by: (Signature)	Printed Name:	Company:	Date & Time:	Relinquished by: (Signature)	Printed Name:	Company:	Date & Time:	Received by: (Signature)	Printed Name:	Company:	Date & Time:
		Tyler Scott	Floyd Snider	3.24.22 13:37		Dimitri Lominadze	ARI	3/24/22 1337								

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 22C0454	Turn-around Requested:	Page: 1	of 1
ARI Client Company: Floyd | Snider	Phone: 206-292-2078	Date: 3/24/22	Ice Present?
Client Contact: Amanda McKay		No. of Coolers:	Cooler Temps: 4.6; 0.5; 1.9
Client Project Name: POS-CLA			
Client Project #:	Samplers: A. Jumper & T. Scott		

Analytical Resources, LLC
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: Dissolved Arsenic	Analysis Requested: Dioxin/Furan	Notes/Comments
MW-C1-VB1-032422	3/24/22	12:33	gw	3	X	X	Dissolved As to be lab filtered
MW-C1-VB1-032422-D		12:37	gw	3	X	X	
MW-C2-032422		11:34	gw	1	X		
MW-C3-032422		11:33	gw	1	X		
MW-VB2-032422		10:30	gw	3	X	X	

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
	Printed Name: Tyler Scott	Printed Name: Dimitri Lominadze	Printed Name:	Printed Name:
	Company: Floyd Snider	Company: ARI	Company:	Company:
	Date & Time: 3.24.22 13:37	Date & Time: 3/24/22 1337	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, LLC
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: Floyd Snider
Project Name: POS-LLA
COC No(s): NA
Delivered by: Fed-Ex UPS Courier Hand Delivered Other:
Assigned ARI Job No: 22C0456
Tracking No: NA

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of the cooler?	YES	NO
Were custody papers included with the cooler?	YES	NO
Were custody papers properly filled out (ink, signed, etc.)	YES	NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry): 4.6 | 0.5 | 1.9
Time: 1337
If cooler temperature is out of compliance fill out form 00070F
Temp Gun ID#: 2565

Cooler Accepted by: DL Date: 3/24/22 Time: 1337

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	NO
What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other:			
Was sufficient ice used (if appropriate)?	NA	YES	NO
How were bottles sealed in plastic bags?	Individually	Grouped	Not
Did all bottles arrive in good condition (unbroken)?		YES	NO
Were all bottle labels complete and legible?		YES	NO
Did the number of containers listed on COC match with the number of containers received?		YES	NO
Did all bottle labels and tags agree with custody papers?		YES	NO
Were all bottles used correct for the requested analyses?		YES	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) ...	NA	YES	NO
Were all VOC vials free of air bubbles?	NA	YES	NO
Was sufficient amount of sample sent in each bottle?		YES	NO
Date VOC Trip Blank was made at ARI	NA		

Were the sample(s) split by ARI? NA YES Date/Time: Equipment: Split by:

Samples Logged by: Date: 03/26/2022 Time: Labels checked by:

*** Notify Project Manager of discrepancies or concerns ***

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: Date:

Analytical Resources, LLC
Analytical Chemists and Consultants

Printed: 3/26/2022 2:12:41PM

WORK ORDER

22C0456

Samples will be discarded 90 days after submission of a final report unless other instructions are received.

Client: Floyd - Snider
Project Manager: Kelly Bottem

Project: Lora Lake 2021-2023 sec II. 5.3.21
Project Number: Lora Lake 2021-2023 sec II. 5.3.21

Preservation Confirmation

Container ID	Container Type	pH
22C0456-01 A	HDPE NM, 500 mL	>2 fail
22C0456-01 B	Glass NM, Amber, 1000 mL	
22C0456-01 C	Glass NM, Amber, 1000 mL	
22C0456-02 A	HDPE NM, 500 mL	>2 fail
22C0456-02 B	Glass NM, Amber, 1000 mL	
22C0456-02 C	Glass NM, Amber, 1000 mL	
22C0456-03 A	HDPE NM, 500 mL	>2 fail
22C0456-03 B	Glass NM, Amber, 1000 mL	
22C0456-03 C	Glass NM, Amber, 1000 mL	
22C0456-04 A	HDPE NM, 500 mL	>2 fail
22C0456-04 B	Glass NM, Amber, 1000 mL	
22C0456-04 C	Glass NM, Amber, 1000 mL	
22C0456-05 A	HDPE NM, 500 mL	>2 fail
22C0456-05 B	Glass NM, Amber, 1000 mL	
22C0456-05 C	Glass NM, Amber, 1000 mL	
22C0456-06 A	HDPE NM, 500 mL	>2 fail
22C0456-06 B	Glass NM, Amber, 1000 mL	
22C0456-06 C	Glass NM, Amber, 1000 mL	
22C0456-07 A	HDPE NM, 500 mL	>2 fail
22C0456-07 B	Glass NM, Amber, 1000 mL	
22C0456-07 C	Glass NM, Amber, 1000 mL	
22C0456-08 A	HDPE NM, 500 mL	>2 fail
22C0456-08 B	Glass NM, Amber, 1000 mL	
22C0456-08 C	Glass NM, Amber, 1000 mL	
22C0456-09 A	HDPE NM, 500 mL	>2 fail
22C0456-09 B	Glass NM, Amber, 1000 mL	
22C0456-09 C	Glass NM, Amber, 1000 mL	
22C0456-10 A	HDPE NM, 500 mL	>2 fail
22C0456-10 B	Glass NM, Amber, 1000 mL	
22C0456-10 C	Glass NM, Amber, 1000 mL	
22C0456-11 A	HDPE NM, 500 mL	>2 fail
22C0456-11 B	Glass NM, Amber, 1000 mL	
22C0456-11 C	Glass NM, Amber, 1000 mL	
22C0456-12 A	HDPE NM, 500 mL	>2 fail

Reviewed By

Date

Analytical Resources, LLC
Analytical Chemists and Consultants

Printed: 3/26/2022 2:12:41PM

WORK ORDER

22C0456

Samples will be discarded 90 days after submission of a final report unless other instructions are received.

Client: Floyd - Snider | **Project Manager: Kelly Bottem**

Project: Lora Lake 2021-2023 sec II. 5.3.21 | **Project Number: Lora Lake 2021-2023 sec II. 5.3.21**

22C0456-12 B	Glass NM, Amber, 1000 mL	
22C0456-12 C	Glass NM, Amber, 1000 mL	
22C0456-13 A	HDPE NM, 500 mL	>2 fail
22C0456-14 A	HDPE NM, 500 mL	>2 fail
22C0456-15 A	HDPE NM, 500 mL	>2 fail
22C0456-15 B	Glass NM, Amber, 1000 mL	
22C0456-15 C	Glass NM, Amber, 1000 mL	

Preservation Confirmed By

03/26/2022
Date

Reviewed By

Date

Analytical Resources, LLC
Analytical Chemists and Consultants

Printed: 3/26/2022 2:12:41PM

WORK ORDER

22C0456

Samples will be discarded 90 days after submission of a final report unless other instructions are received.

Client: Floyd - Snider
Project Manager: Kelly Bottem

Project: Lora Lake 2021-2023 sec II. 5.3.21
Project Number: Lora Lake 2021-2023 sec II. 5.3.21

Preservation Confirmation

Container ID	Container Type	pH	
22C0456-01 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-01 B	Glass NM, Amber, 1000 mL		
22C0456-01 C	Glass NM, Amber, 1000 mL		
22C0456-02 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-02 B	Glass NM, Amber, 1000 mL		
22C0456-02 C	Glass NM, Amber, 1000 mL		
22C0456-03 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-03 B	Glass NM, Amber, 1000 mL		
22C0456-03 C	Glass NM, Amber, 1000 mL		
22C0456-04 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-04 B	Glass NM, Amber, 1000 mL		
22C0456-04 C	Glass NM, Amber, 1000 mL		
22C0456-05 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-05 B	Glass NM, Amber, 1000 mL		
22C0456-05 C	Glass NM, Amber, 1000 mL		
22C0456-06 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-06 B	Glass NM, Amber, 1000 mL		
22C0456-06 C	Glass NM, Amber, 1000 mL		
22C0456-07 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-07 B	Glass NM, Amber, 1000 mL		
22C0456-07 C	Glass NM, Amber, 1000 mL		
22C0456-08 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-08 B	Glass NM, Amber, 1000 mL		
22C0456-08 C	Glass NM, Amber, 1000 mL		
22C0456-09 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-09 B	Glass NM, Amber, 1000 mL		
22C0456-09 C	Glass NM, Amber, 1000 mL		
22C0456-10 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-10 B	Glass NM, Amber, 1000 mL		
22C0456-10 C	Glass NM, Amber, 1000 mL		
22C0456-11 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-11 B	Glass NM, Amber, 1000 mL		
22C0456-11 C	Glass NM, Amber, 1000 mL		
22C0456-12 A	HDPE NM, 500 mL	>2 fail	(1)

Reviewed By

Date

Analytical Resources, LLC
Analytical Chemists and Consultants

Printed: 3/26/2022 2:12:41PM

WORK ORDER

22C0456

Samples will be discarded 90 days after submission of a final report unless other instructions are received.

Client: Floyd - Snider | **Project Manager:** Kelly Bottem

Project: Lora Lake 2021-2023 sec II. 5.3.21 | **Project Number:** Lora Lake 2021-2023 sec II. 5.3.21

22C0456-12 B	Glass NM, Amber, 1000 mL		
22C0456-12 C	Glass NM, Amber, 1000 mL		
22C0456-13 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-14 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-15 A	HDPE NM, 500 mL	>2 fail	(1)
22C0456-15 B	Glass NM, Amber, 1000 mL		
22C0456-15 C	Glass NM, Amber, 1000 mL		

Preservation Confirmed By

03/26/2022
Date

(1) filters at 0.45µ and preserved to pH<2 with 0.75mL conc. HNO3 (K2722) MM 3/28/22

Reviewed By

Date

Analytical Resources, LLC
Analytical Chemists and Consultants

Floyd - Snider	Project: Lora Lake 2021-2023 sec II. 5.3.21	
601 Union Street Two Union Square, Suite 600	Project Number: Lora Lake 2021-2023 sec II. 5.3.21	**Reported:**
Seattle, WA 98101-2341	Project Manager: Amanda McKay	04/15/2022 10:57

ANALYTICAL REPORT FOR SAMPLES

Laboratory ID	Sample ID	Matrix	Date Sampled	Date Received
22C0456-01	MW-CP1-032322	Water	03/23/22 14:26	03/24/22 13:35
22C0456-02	MW-CP1-032322-D	Water	03/23/22 14:36	03/24/22 13:35
22C0456-03	MW-CP2-032322	Water	03/23/22 13:26	03/24/22 13:35
22C0456-04	MW-CP3-032322	Water	03/23/22 13:25	03/24/22 13:35
22C0456-05	MW-CP4-032322	Water	03/23/22 12:06	03/24/22 13:35
22C0456-06	MW-CP5-032322	Water	03/23/22 12:25	03/24/22 13:35
22C0456-07	MW-CP6-032322	Water	03/23/22 11:15	03/24/22 13:35
22C0456-08	MW-CP7-032322	Water	03/23/22 11:06	03/24/22 13:35
22C0456-09	MW-VB3-032322	Water	03/23/22 09:36	03/24/22 13:35
22C0456-10	HCOO-B312-032322	Water	03/23/22 15:00	03/24/22 13:35
22C0456-11	MW-C1-VB1-032422	Water	03/24/22 12:33	03/24/22 13:35
22C0456-12	MW-C1-VB1-032422-D	Water	03/24/22 12:37	03/24/22 13:35
22C0456-13	MW-C2-032422	Water	03/24/22 11:36	03/24/22 13:35
22C0456-14	MW-C3-032422	Water	03/24/22 11:33	03/24/22 13:35
22C0456-15	MW-C1-VB2-032422	Water	03/24/22 10:30	03/24/22 13:35

Floyd - Snider	Project: Lora Lake 2021-2023 sec II. 5.3.21	
601 Union Street Two Union Square, Suite 600	Project Number: Lora Lake 2021-2023 sec II. 5.3.21	**Reported:**
Seattle WA, 98101-2341	Project Manager: Amanda McKay	15-Apr-2022 10:57

Case Narrative

Dioxin/Furans - EPA Method 1613

The sample(s) were extracted and analyzed within the recommended holding times. Analysis was performed using an application specific column developed by Restek. The RTX-DIoxin2 column has unique isomer separation for the 2378-TCDF, eliminating the need for confirmation analysis.

Initial and continuing calibrations were within method requirements.

Labeled internal standard areas were within limits.

The cleanup surrogate percent recoveries were within control limits.

The method blank(s) contained OCDD. Associated samples that contain OCDD have been flagged with a "B" qualifer.

The OPR (Ongoing Precision and Recovery) standard percent recoveries were within control limits.

Dissolved Metals - EPA Method 6020B

The sample(s) were digested and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

The method blank(s) were clean at the reporting limits.

The blank spike (BS/LCS) percent recoveries were within control limits.

The matrix spike (MS) percent recoveries and the duplicate (DUP) relative percent difference (RPD) were within advisory control limits.

QUALIFIERS AND NOTES

Qualifier	Definition
U	This analyte is not detected above the reporting limit (RL) or if noted, not detected above the limit of detection (LOD).
J	Estimated concentration value detected below the reporting limit.
EMPC	Estimated Maximum Possible Concentration qualifier for HRGCMS Dioxin
D	The reported value is from a dilution
B	This analyte was detected in the method blank.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-CP1-032322

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-01 B	File ID:	22040807
Sampled:	03/23/22 14:26	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 16:04
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	1060 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	1.11	9.43	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	1.38	9.43	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1		1.318-1.783	1.08	9.43	ND	pg/L	U
57117-31-4	2,3,4,7,8-PeCDF	1		1.318-1.783	1.01	9.43	ND	pg/L	U
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.60	9.43	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1		1.054-1.426	1.30	9.43	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1		1.054-1.426	1.35	9.43	ND	pg/L	U
60851-34-5	2,3,4,6,7,8-HxCDF	1		1.054-1.426	1.33	9.43	ND	pg/L	U
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.60	9.43	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1		1.054-1.426	1.74	9.43	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	1.65	9.43	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1		1.054-1.426	1.83	9.43	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1		0.893-1.208	1.18	18.9	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	1.72	9.43	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1	1.002	0.893-1.208	1.49	9.43	1.79	pg/L	J
39001-02-0	OCDF	1		0.757-1.024	2.71	18.9	ND	pg/L	U
3268-87-9	OCDD	1	0.786	0.757-1.024	3.36	47.2	17.3	pg/L	J, B

Homologue Groups

55722-27-5	Total TCDF	1	0.000			9.43	ND	pg/L	
41903-57-5	Total TCDD	1	0.000			9.43	ND	pg/L	
30402-15-4	Total PeCDF	1	0.000			9.43	ND	pg/L	
36088-22-9	Total PeCDD	1	0.000			9.43	ND	pg/L	
55684-94-1	Total HxCDF	1	0.000			9.43	ND	pg/L	
34465-46-8	Total HxCDD	1	0.000			9.43	ND	pg/L	
38998-75-3	Total HpCDF	1	0.000			9.43	ND	pg/L	
37871-00-4	Total HpCDD	1	0.000			9.43	1.79	pg/L	

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.023

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 2.29

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MW-CP1-032322

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-01	File ID:	22040807
Sampled:	03/23/22 14:26	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 16:04
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1060 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.791	0.655-0.886	2.74	94.7	24 - 169 %	
13C12-2,3,7,8-TCDD		0.793	0.655-0.886	2.48	108	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.553	1.318-1.783	2.32	96.5	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.582	1.318-1.783	2.45	97.7	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.609	1.318-1.783	2.22	99.7	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.506	0.434-0.587	2.44	96.1	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.513	0.434-0.587	2.29	97.7	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.528	0.434-0.587	2.62	97.6	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.491	0.434-0.587	3.04	104	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.255	1.054-1.426	3.14	97.4	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.198	1.054-1.426	2.87	97.9	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.442	0.374-0.506	3.14	93.1	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.462	0.374-0.506	4.07	93.0	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		1.093	0.893-1.208	3.91	99.5	23 - 140 %	
13C12-OCDD		0.869	0.757-1.024	5.11	104	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		0.94	104	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-CP1-032322-D

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-02 B	File ID:	22040808
Sampled:	03/23/22 14:36	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 16:52
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	1040 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	0.78	9.62	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	1.19	9.62	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1	2.303	1.318-1.783	0.80	9.62	1.60	pg/L	EMPC, J
57117-31-4	2,3,4,7,8-PeCDF	1		1.318-1.783	0.75	9.62	ND	pg/L	U
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.43	9.62	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1	0.957	1.054-1.426	0.89	9.62	1.85	pg/L	EMPC, J
57117-44-9	1,2,3,6,7,8-HxCDF	1	1.322	1.054-1.426	0.88	9.62	1.83	pg/L	J
60851-34-5	2,3,4,6,7,8-HxCDF	1	1.630	1.054-1.426	0.87	9.62	0.99	pg/L	EMPC, J
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.15	9.62	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1	1.697	1.054-1.426	1.30	9.62	1.44	pg/L	EMPC, J
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	1.23	9.62	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1		1.054-1.426	1.36	9.62	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1		0.893-1.208	0.90	19.2	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	1.20	9.62	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1	0.512	0.893-1.208	1.23	9.62	3.19	pg/L	EMPC, J
39001-02-0	OCDF	1		0.757-1.024	1.70	19.2	ND	pg/L	U
3268-87-9	OCDD	1	0.788	0.757-1.024	2.33	48.1	15.7	pg/L	J, B

Homologue Groups

55722-27-5	Total TCDF	1	0.000			9.62	ND	pg/L
41903-57-5	Total TCDD	1	0.000			9.62	ND	pg/L
30402-15-4	Total PeCDF	1	0.000			9.62	ND	pg/L
36088-22-9	Total PeCDD	1	0.000			9.62	ND	pg/L
55684-94-1	Total HxCDF	1	0.000			9.62	1.83	pg/L
34465-46-8	Total HxCDD	1	0.000			9.62	ND	pg/L
38998-75-3	Total HpCDF	1	0.000			9.62	ND	pg/L
37871-00-4	Total HpCDD	1	0.000			9.62	ND	pg/L

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.696

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 2.35

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MW-CP1-032322-D

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-02	File ID:	22040808
Sampled:	03/23/22 14:36	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 16:52
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1040 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.785	0.655-0.886	2.01	95.7	24 - 169 %	
13C12-2,3,7,8-TCDD		0.759	0.655-0.886	2.00	109	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.572	1.318-1.783	3.18	96.9	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.547	1.318-1.783	3.35	97.2	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.604	1.318-1.783	1.73	98.9	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.499	0.434-0.587	2.68	95.4	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.512	0.434-0.587	2.51	94.2	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.511	0.434-0.587	2.87	98.0	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.517	0.434-0.587	3.34	101	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.251	1.054-1.426	3.35	94.6	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.227	1.054-1.426	3.06	95.3	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.442	0.374-0.506	2.72	92.2	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.452	0.374-0.506	3.52	97.9	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		1.086	0.893-1.208	3.34	101	23 - 140 %	
13C12-OCDD		0.927	0.757-1.024	5.44	111	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		1.14	106	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-CP2-032322

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-03 B	File ID:	22040809
Sampled:	03/23/22 13:26	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 17:40
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	1060 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	0.94	9.43	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	1.44	9.43	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1		1.318-1.783	1.14	9.43	ND	pg/L	U
57117-31-4	2,3,4,7,8-PeCDF	1		1.318-1.783	1.04	9.43	ND	pg/L	U
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.93	9.43	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1		1.054-1.426	1.36	9.43	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1		1.054-1.426	1.39	9.43	ND	pg/L	U
60851-34-5	2,3,4,6,7,8-HxCDF	1		1.054-1.426	1.39	9.43	ND	pg/L	U
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.66	9.43	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1		1.054-1.426	1.69	9.43	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	1.65	9.43	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1		1.054-1.426	1.80	9.43	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1		0.893-1.208	1.15	18.9	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	1.59	9.43	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1		0.893-1.208	1.64	9.43	ND	pg/L	U
39001-02-0	OCDF	1		0.757-1.024	2.86	18.9	ND	pg/L	U
3268-87-9	OCDD	1		0.757-1.024	3.60	47.2	ND	pg/L	U

Homologue Groups

55722-27-5	Total TCDF	1	0.000			9.43	ND	pg/L
41903-57-5	Total TCDD	1	0.000			9.43	ND	pg/L
30402-15-4	Total PeCDF	1	0.000			9.43	ND	pg/L
36088-22-9	Total PeCDD	1	0.000			9.43	ND	pg/L
55684-94-1	Total HxCDF	1	0.000			9.43	ND	pg/L
34465-46-8	Total HxCDD	1	0.000			9.43	ND	pg/L
38998-75-3	Total HpCDF	1	0.000			9.43	ND	pg/L
37871-00-4	Total HpCDD	1	0.000			9.43	ND	pg/L

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.000

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 2.47

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MW-CP2-032322

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-03	File ID:	22040809
Sampled:	03/23/22 13:26	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 17:40
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1060 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.796	0.655-0.886	2.49	101	24 - 169 %	
13C12-2,3,7,8-TCDD		0.777	0.655-0.886	2.46	107	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.609	1.318-1.783	3.92	104	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.560	1.318-1.783	4.14	104	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.616	1.318-1.783	2.75	99.2	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.516	0.434-0.587	3.78	101	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.517	0.434-0.587	3.54	100	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.506	0.434-0.587	4.04	101	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.486	0.434-0.587	4.70	109	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.272	1.054-1.426	3.15	95.7	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.228	1.054-1.426	2.88	96.1	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.458	0.374-0.506	4.60	113	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.449	0.374-0.506	5.96	115	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		1.096	0.893-1.208	4.19	116	23 - 140 %	
13C12-OCDD		0.915	0.757-1.024	6.92	124	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		1.09	105	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-CP3-032322

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-04 B	File ID:	22040810
Sampled:	03/23/22 13:25	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 18:28
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	970 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	0.95	10.3	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	1.31	10.3	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1		1.318-1.783	1.02	10.3	ND	pg/L	U
57117-31-4	2,3,4,7,8-PeCDF	1		1.318-1.783	0.96	10.3	ND	pg/L	U
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.53	10.3	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1		1.054-1.426	1.31	10.3	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1		1.054-1.426	1.30	10.3	ND	pg/L	U
60851-34-5	2,3,4,6,7,8-HxCDF	1		1.054-1.426	1.33	10.3	ND	pg/L	U
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.69	10.3	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1		1.054-1.426	1.75	10.3	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	1.67	10.3	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1	0.873	1.054-1.426	1.84	10.3	1.24	pg/L	EMPC, J
67562-39-4	1,2,3,4,6,7,8-HpCDF	1		0.893-1.208	1.25	20.6	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	1.71	10.3	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1		0.893-1.208	1.78	10.3	ND	pg/L	U
39001-02-0	OCDF	1		0.757-1.024	2.66	20.6	ND	pg/L	U
3268-87-9	OCDD	1		0.757-1.024	3.54	51.5	ND	pg/L	U

Homologue Groups

55722-27-5	Total TCDF	1	0.000			10.3	ND	pg/L
41903-57-5	Total TCDD	1	0.000			10.3	ND	pg/L
30402-15-4	Total PeCDF	1	0.000			10.3	ND	pg/L
36088-22-9	Total PeCDD	1	0.000			10.3	ND	pg/L
55684-94-1	Total HxCDF	1	0.000			10.3	1.25	pg/L
34465-46-8	Total HxCDD	1	0.000			10.3	ND	pg/L
38998-75-3	Total HpCDF	1	0.000			10.3	ND	pg/L
37871-00-4	Total HpCDD	1	0.000			10.3	ND	pg/L

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.124

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 2.23

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MW-CP3-032322

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-04	File ID:	22040810
Sampled:	03/23/22 13:25	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 18:28
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	970 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.796	0.655-0.886	2.28	90.8	24 - 169 %	
13C12-2,3,7,8-TCDD		0.764	0.655-0.886	2.15	103	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.579	1.318-1.783	3.09	93.4	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.584	1.318-1.783	3.26	90.1	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.594	1.318-1.783	2.24	91.4	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.501	0.434-0.587	3.52	91.9	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.510	0.434-0.587	3.30	93.9	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.515	0.434-0.587	3.76	91.8	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.510	0.434-0.587	4.38	94.9	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.265	1.054-1.426	2.85	92.0	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.212	1.054-1.426	2.61	93.6	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.449	0.374-0.506	3.84	86.9	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.443	0.374-0.506	4.97	89.6	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		0.995	0.893-1.208	3.59	95.6	23 - 140 %	
13C12-OCDD		0.892	0.757-1.024	5.56	94.5	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		1.07	99.2	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-CP4-032322

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-05 B	File ID:	22040811
Sampled:	03/23/22 12:06	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 19:16
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	1055 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	0.89	9.48	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	1.22	9.48	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1		1.318-1.783	1.20	9.48	ND	pg/L	U
57117-31-4	2,3,4,7,8-PeCDF	1		1.318-1.783	1.12	9.48	ND	pg/L	U
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.31	9.48	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1		1.054-1.426	1.06	9.48	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1		1.054-1.426	1.07	9.48	ND	pg/L	U
60851-34-5	2,3,4,6,7,8-HxCDF	1		1.054-1.426	1.06	9.48	ND	pg/L	U
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.33	9.48	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1		1.054-1.426	1.53	9.48	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	1.54	9.48	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1		1.054-1.426	1.66	9.48	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1		0.893-1.208	1.06	19.0	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	1.58	9.48	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1		0.893-1.208	1.47	9.48	ND	pg/L	U
39001-02-0	OCDF	1		0.757-1.024	2.10	19.0	ND	pg/L	U
3268-87-9	OCDD	1	1.297	0.757-1.024	1.85	47.4	5.33	pg/L	EMPC, J, B

Homologue Groups

55722-27-5	Total TCDF	1	0.000			9.48	ND	pg/L
41903-57-5	Total TCDD	1	0.000			9.48	ND	pg/L
30402-15-4	Total PeCDF	1	0.000			9.48	ND	pg/L
36088-22-9	Total PeCDD	1	0.000			9.48	ND	pg/L
55684-94-1	Total HxCDF	1	0.000			9.48	ND	pg/L
34465-46-8	Total HxCDD	1	0.000			9.48	2.34	pg/L
38998-75-3	Total HpCDF	1	0.000			9.48	ND	pg/L
37871-00-4	Total HpCDD	1	0.000			9.48	ND	pg/L

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.002

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 1.98

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MW-CP4-032322

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-05	File ID:	22040811
Sampled:	03/23/22 12:06	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 19:16
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1055 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.770	0.655-0.886	1.77	89.3	24 - 169 %	
13C12-2,3,7,8-TCDD		0.785	0.655-0.886	2.03	101	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.610	1.318-1.783	2.51	91.1	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.575	1.318-1.783	2.65	90.6	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.664	1.318-1.783	2.09	93.5	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.504	0.434-0.587	3.05	91.4	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.507	0.434-0.587	2.86	90.1	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.500	0.434-0.587	3.26	92.0	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.502	0.434-0.587	3.80	94.1	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.293	1.054-1.426	2.30	88.9	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.250	1.054-1.426	2.11	90.0	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.463	0.374-0.506	2.81	87.8	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.459	0.374-0.506	3.64	88.9	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		1.046	0.893-1.208	3.82	89.7	23 - 140 %	
13C12-OCDD		0.904	0.757-1.024	5.05	97.1	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		0.86	96.7	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-CP5-032322

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-06 B	File ID:	22040812
Sampled:	03/23/22 12:25	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 20:04
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	1018 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	0.95	9.82	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	1.38	9.82	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1		1.318-1.783	1.09	9.82	ND	pg/L	U
57117-31-4	2,3,4,7,8-PeCDF	1		1.318-1.783	1.07	9.82	ND	pg/L	U
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.66	9.82	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1		1.054-1.426	1.10	9.82	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1		1.054-1.426	1.07	9.82	ND	pg/L	U
60851-34-5	2,3,4,6,7,8-HxCDF	1		1.054-1.426	1.04	9.82	ND	pg/L	U
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.35	9.82	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1		1.054-1.426	1.55	9.82	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	1.44	9.82	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1		1.054-1.426	1.61	9.82	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1		0.893-1.208	1.25	19.6	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	1.68	9.82	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1		0.893-1.208	1.74	9.82	ND	pg/L	U
39001-02-0	OCDF	1		0.757-1.024	2.40	19.6	ND	pg/L	U
3268-87-9	OCDD	1	0.795	0.757-1.024	2.43	49.1	4.65	pg/L	J, B

Homologue Groups

55722-27-5	Total TCDF	1	0.000			9.82	ND	pg/L
41903-57-5	Total TCDD	1	0.000			9.82	ND	pg/L
30402-15-4	Total PeCDF	1	0.000			9.82	ND	pg/L
36088-22-9	Total PeCDD	1	0.000			9.82	ND	pg/L
55684-94-1	Total HxCDF	1	0.000			9.82	ND	pg/L
34465-46-8	Total HxCDD	1	0.000			9.82	ND	pg/L
38998-75-3	Total HpCDF	1	0.000			9.82	ND	pg/L
37871-00-4	Total HpCDD	1	0.000			9.82	ND	pg/L

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.001

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 2.23

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MW-CP5-032322

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-06	File ID:	22040812
Sampled:	03/23/22 12:25	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 20:04
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1018 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.785	0.655-0.886	1.96	88.3	24 - 169 %	
13C12-2,3,7,8-TCDD		0.759	0.655-0.886	2.46	99.3	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.580	1.318-1.783	2.41	92.4	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.559	1.318-1.783	2.54	90.8	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.663	1.318-1.783	2.52	94.2	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.501	0.434-0.587	3.20	89.4	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.493	0.434-0.587	3.00	89.7	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.507	0.434-0.587	3.42	92.0	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.512	0.434-0.587	3.99	98.0	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.244	1.054-1.426	3.17	92.0	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.245	1.054-1.426	2.89	89.5	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.459	0.374-0.506	3.73	88.4	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.447	0.374-0.506	4.83	94.8	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		1.071	0.893-1.208	3.75	94.3	23 - 140 %	
13C12-OCDD		0.909	0.757-1.024	5.75	99.2	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		0.88	95.4	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-CP6-032322

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-07 B	File ID:	22040813
Sampled:	03/23/22 11:15	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 20:52
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	1027 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	0.97	9.74	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	0.98	9.74	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1		1.318-1.783	1.05	9.74	ND	pg/L	U
57117-31-4	2,3,4,7,8-PeCDF	1		1.318-1.783	0.97	9.74	ND	pg/L	U
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.41	9.74	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1		1.054-1.426	1.18	9.74	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1		1.054-1.426	1.22	9.74	ND	pg/L	U
60851-34-5	2,3,4,6,7,8-HxCDF	1		1.054-1.426	1.20	9.74	ND	pg/L	U
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.55	9.74	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1		1.054-1.426	1.50	9.74	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	1.44	9.74	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1		1.054-1.426	1.59	9.74	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1		0.893-1.208	1.12	19.5	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	1.63	9.74	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1	1.067	0.893-1.208	1.46	9.74	2.46	pg/L	J
39001-02-0	OCDF	1		0.757-1.024	2.08	19.5	ND	pg/L	U
3268-87-9	OCDD	1	0.839	0.757-1.024	2.26	48.7	34.6	pg/L	J, B

Homologue Groups

55722-27-5	Total TCDF	1	0.000			9.74	ND	pg/L
41903-57-5	Total TCDD	1	0.000			9.74	ND	pg/L
30402-15-4	Total PeCDF	1	0.000			9.74	ND	pg/L
36088-22-9	Total PeCDD	1	0.000			9.74	0.75	pg/L
55684-94-1	Total HxCDF	1	0.000			9.74	ND	pg/L
34465-46-8	Total HxCDD	1	0.000			9.74	ND	pg/L
38998-75-3	Total HpCDF	1	0.000			9.74	ND	pg/L
37871-00-4	Total HpCDD	1	0.000			9.74	2.46	pg/L

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.035

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 1.94

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MW-CP6-032322

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-07	File ID:	22040813
Sampled:	03/23/22 11:15	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 20:52
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1027 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.784	0.655-0.886	1.70	94.6	24 - 169 %	
13C12-2,3,7,8-TCDD		0.775	0.655-0.886	1.87	107	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.548	1.318-1.783	2.71	94.2	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.567	1.318-1.783	2.86	94.7	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.586	1.318-1.783	2.07	97.4	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.506	0.434-0.587	3.64	93.6	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.517	0.434-0.587	3.41	92.9	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.498	0.434-0.587	3.89	93.2	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.507	0.434-0.587	4.53	96.8	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.261	1.054-1.426	3.65	93.9	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.242	1.054-1.426	3.34	90.1	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.457	0.374-0.506	3.34	88.6	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.468	0.374-0.506	4.33	92.3	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		1.110	0.893-1.208	4.12	96.4	23 - 140 %	
13C12-OCDD		0.905	0.757-1.024	6.31	96.1	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		0.86	103	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-CP7-032322

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-08 B	File ID:	22040816
Sampled:	03/23/22 11:06	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 23:23
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	1053 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	0.79	9.50	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	1.01	9.50	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1	1.900	1.318-1.783	0.94	9.50	1.15	pg/L	EMPC, J
57117-31-4	2,3,4,7,8-PeCDF	1		1.318-1.783	0.91	9.50	ND	pg/L	U
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.29	9.50	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1		1.054-1.426	0.94	9.50	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1		1.054-1.426	0.96	9.50	ND	pg/L	U
60851-34-5	2,3,4,6,7,8-HxCDF	1		1.054-1.426	0.96	9.50	ND	pg/L	U
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.27	9.50	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1		1.054-1.426	0.94	9.50	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	0.89	9.50	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1		1.054-1.426	0.98	9.50	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1		0.893-1.208	0.76	19.0	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	1.11	9.50	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1		0.893-1.208	1.44	9.50	ND	pg/L	U
39001-02-0	OCDF	1		0.757-1.024	2.03	19.0	ND	pg/L	U
3268-87-9	OCDD	1	0.662	0.757-1.024	1.95	47.5	3.28	pg/L	EMPC, J, B

Homologue Groups

55722-27-5	Total TCDF	1	0.000			9.50	ND	pg/L
41903-57-5	Total TCDD	1	0.000			9.50	ND	pg/L
30402-15-4	Total PeCDF	1	0.000			9.50	2.70	pg/L
36088-22-9	Total PeCDD	1	0.000			9.50	ND	pg/L
55684-94-1	Total HxCDF	1	0.000			9.50	ND	pg/L
34465-46-8	Total HxCDD	1	0.000			9.50	1.26	pg/L
38998-75-3	Total HpCDF	1	0.000			9.50	ND	pg/L
37871-00-4	Total HpCDD	1	0.000			9.50	ND	pg/L

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.035

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 1.73

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MW-CP7-032322

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-08	File ID:	22040816
Sampled:	03/23/22 11:06	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 23:23
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1053 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.794	0.655-0.886	1.51	94.2	24 - 169 %	
13C12-2,3,7,8-TCDD		0.758	0.655-0.886	2.11	105	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.498	1.318-1.783	1.81	94.5	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.603	1.318-1.783	1.91	95.4	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.607	1.318-1.783	1.74	96.1	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.507	0.434-0.587	2.42	94.1	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.502	0.434-0.587	2.27	95.9	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.496	0.434-0.587	2.59	94.4	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.533	0.434-0.587	3.01	101	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.249	1.054-1.426	3.43	94.4	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.248	1.054-1.426	3.14	99.2	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.440	0.374-0.506	3.14	96.9	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.470	0.374-0.506	4.06	94.4	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		1.104	0.893-1.208	3.77	98.3	23 - 140 %	
13C12-OCDD		0.937	0.757-1.024	7.23	99.9	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		0.79	99.9	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-VB3-032322

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-09 B	File ID:	22040817
Sampled:	03/23/22 09:36	Prepared:	04/02/22 06:55	Analyzed:	04/09/22 00:11
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	1030 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	0.98	9.71	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	1.09	9.71	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1		1.318-1.783	1.04	9.71	ND	pg/L	U
57117-31-4	2,3,4,7,8-PeCDF	1		1.318-1.783	1.03	9.71	ND	pg/L	U
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.72	9.71	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1		1.054-1.426	1.28	9.71	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1		1.054-1.426	1.29	9.71	ND	pg/L	U
60851-34-5	2,3,4,6,7,8-HxCDF	1		1.054-1.426	1.38	9.71	ND	pg/L	U
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.65	9.71	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1		1.054-1.426	1.56	9.71	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	1.43	9.71	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1		1.054-1.426	1.61	9.71	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1	2.553	0.893-1.208	1.39	19.4	2.17	pg/L	EMPC, J
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	2.03	9.71	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1	1.720	0.893-1.208	2.45	9.71	3.18	pg/L	EMPC, J
39001-02-0	OCDF	1		0.757-1.024	2.50	19.4	ND	pg/L	U
3268-87-9	OCDD	1	0.857	0.757-1.024	4.44	48.5	23.9	pg/L	J, B

Homologue Groups

55722-27-5	Total TCDF	1	0.000			9.71	ND	pg/L
41903-57-5	Total TCDD	1	0.000			9.71	ND	pg/L
30402-15-4	Total PeCDF	1	0.000			9.71	ND	pg/L
36088-22-9	Total PeCDD	1	0.000			9.71	ND	pg/L
55684-94-1	Total HxCDF	1	0.000			9.71	ND	pg/L
34465-46-8	Total HxCDD	1	0.000			9.71	ND	pg/L
38998-75-3	Total HpCDF	1	0.000			9.71	ND	pg/L
37871-00-4	Total HpCDD	1	0.000			9.71	ND	pg/L

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.061

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 2.21

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MW-VB3-032322

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-09	File ID:	22040817
Sampled:	03/23/22 09:36	Prepared:	04/02/22 06:55	Analyzed:	04/09/22 00:11
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1030 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.786	0.655-0.886	1.54	76.5	24 - 169 %	
13C12-2,3,7,8-TCDD		0.763	0.655-0.886	1.92	85.5	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.516	1.318-1.783	3.11	76.3	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.515	1.318-1.783	3.28	76.2	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.610	1.318-1.783	1.74	76.1	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.502	0.434-0.587	3.54	77.8	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.509	0.434-0.587	3.32	79.6	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.542	0.434-0.587	3.78	80.5	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.497	0.434-0.587	4.41	82.4	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.249	1.054-1.426	2.44	78.0	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.218	1.054-1.426	2.23	80.3	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.433	0.374-0.506	3.35	75.4	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.430	0.374-0.506	4.34	76.3	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		1.096	0.893-1.208	3.46	76.4	23 - 140 %	
13C12-OCDD		0.904	0.757-1.024	6.63	73.0	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		0.67	82.8	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

HCOO-B312-032322

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-10 B	File ID:	22040818
Sampled:	03/23/22 15:00	Prepared:	04/02/22 06:55	Analyzed:	04/09/22 00:59
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	1017 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	0.64	9.83	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	1.11	9.83	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1		1.318-1.783	0.95	9.83	ND	pg/L	U
57117-31-4	2,3,4,7,8-PeCDF	1	0.393	1.318-1.783	0.92	9.83	1.70	pg/L	EMPC, J
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.48	9.83	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1		1.054-1.426	0.92	9.83	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1	0.774	1.054-1.426	0.97	9.83	0.97	pg/L	EMPC, J
60851-34-5	2,3,4,6,7,8-HxCDF	1	1.075	1.054-1.426	0.94	9.83	1.07	pg/L	J
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.21	9.83	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1		1.054-1.426	1.33	9.83	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	1.31	9.83	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1		1.054-1.426	1.43	9.83	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1		0.893-1.208	1.28	19.7	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	1.89	9.83	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1	1.056	0.893-1.208	1.66	9.83	3.78	pg/L	J
39001-02-0	OCDF	1		0.757-1.024	2.82	19.7	ND	pg/L	U
3268-87-9	OCDD	1	0.755	0.757-1.024	3.51	49.2	23.3	pg/L	EMPC, J, B

Homologue Groups

55722-27-5	Total TCDF	1	0.000			9.83	ND	pg/L
41903-57-5	Total TCDD	1	0.000			9.83	ND	pg/L
30402-15-4	Total PeCDF	1	0.000			9.83	ND	pg/L
36088-22-9	Total PeCDD	1	0.000			9.83	ND	pg/L
55684-94-1	Total HxCDF	1	0.000			9.83	1.07	pg/L
34465-46-8	Total HxCDD	1	0.000			9.83	ND	pg/L
38998-75-3	Total HpCDF	1	0.000			9.83	ND	pg/L
37871-00-4	Total HpCDD	1	0.000			9.83	3.78	pg/L

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.759

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 2.43

Analytical Resources, Incorporated
Analytical Chemists and Consultants

HCOO-B312-032322

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-10	File ID:	22040818
Sampled:	03/23/22 15:00	Prepared:	04/02/22 06:55	Analyzed:	04/09/22 00:59
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1017 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.774	0.655-0.886	1.78	97.9	24 - 169 %	
13C12-2,3,7,8-TCDD		0.758	0.655-0.886	2.10	111	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.582	1.318-1.783	3.69	100	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.582	1.318-1.783	3.89	98.5	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.593	1.318-1.783	2.22	101	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.509	0.434-0.587	3.67	101	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.501	0.434-0.587	3.44	104	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.509	0.434-0.587	3.93	102	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.504	0.434-0.587	4.58	108	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.245	1.054-1.426	2.86	102	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.231	1.054-1.426	2.62	104	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.447	0.374-0.506	4.54	100	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.473	0.374-0.506	5.87	103	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		1.115	0.893-1.208	4.67	106	23 - 140 %	
13C12-OCDD		0.872	0.757-1.024	8.29	113	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		0.80	106	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-C1-VB1-032422

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-11 B	File ID:	22040819
Sampled:	03/24/22 12:33	Prepared:	04/02/22 06:55	Analyzed:	04/09/22 01:47
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	1000 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	0.73	10.0	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	1.12	10.0	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1		1.318-1.783	1.09	10.0	ND	pg/L	U
57117-31-4	2,3,4,7,8-PeCDF	1		1.318-1.783	1.03	10.0	ND	pg/L	U
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.55	10.0	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1		1.054-1.426	1.15	10.0	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1		1.054-1.426	1.17	10.0	ND	pg/L	U
60851-34-5	2,3,4,6,7,8-HxCDF	1		1.054-1.426	1.17	10.0	ND	pg/L	U
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.55	10.0	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1		1.054-1.426	1.91	10.0	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	1.79	10.0	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1		1.054-1.426	1.99	10.0	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1		0.893-1.208	1.01	20.0	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	1.52	10.0	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1		0.893-1.208	1.53	10.0	ND	pg/L	U
39001-02-0	OCDF	1		0.757-1.024	1.96	20.0	ND	pg/L	U
3268-87-9	OCDD	1	2.230	0.757-1.024	2.42	50.0	3.18	pg/L	EMPC, J, B

Homologue Groups

55722-27-5	Total TCDF	1	0.000			10.0	ND	pg/L	
41903-57-5	Total TCDD	1	0.000			10.0	1.47	pg/L	
30402-15-4	Total PeCDF	1	0.000			10.0	ND	pg/L	
36088-22-9	Total PeCDD	1	0.000			10.0	ND	pg/L	
55684-94-1	Total HxCDF	1	0.000			10.0	ND	pg/L	
34465-46-8	Total HxCDD	1	0.000			10.0	ND	pg/L	
38998-75-3	Total HpCDF	1	0.000			10.0	7.16	pg/L	
37871-00-4	Total HpCDD	1	0.000			10.0	ND	pg/L	

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.001

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 2.10

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MW-C1-VB1-032422

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-11	File ID:	22040819
Sampled:	03/24/22 12:33	Prepared:	04/02/22 06:55	Analyzed:	04/09/22 01:47
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1000 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.774	0.655-0.886	1.75	97.6	24 - 169 %	
13C12-2,3,7,8-TCDD		0.770	0.655-0.886	2.26	108	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.597	1.318-1.783	2.40	99.1	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.585	1.318-1.783	2.53	98.1	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.621	1.318-1.783	2.02	98.6	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.499	0.434-0.587	3.44	98.4	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.510	0.434-0.587	3.23	97.8	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.499	0.434-0.587	3.68	97.8	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.516	0.434-0.587	4.29	102	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.269	1.054-1.426	2.91	98.6	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.253	1.054-1.426	2.66	97.6	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.427	0.374-0.506	3.76	97.4	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.454	0.374-0.506	4.86	99.6	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		1.077	0.893-1.208	5.09	101	23 - 140 %	
13C12-OCDD		0.900	0.757-1.024	4.72	104	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		0.81	105	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-C1-VB1-032422-D

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-12 B	File ID:	22040820
Sampled:	03/24/22 12:37	Prepared:	04/02/22 06:55	Analyzed:	04/09/22 02:35
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	1000 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	0.88	10.0	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	1.11	10.0	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1		1.318-1.783	0.91	10.0	ND	pg/L	U
57117-31-4	2,3,4,7,8-PeCDF	1	1.130	1.318-1.783	0.86	10.0	0.88	pg/L	EMPC, J
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.49	10.0	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1		1.054-1.426	1.19	10.0	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1		1.054-1.426	1.18	10.0	ND	pg/L	U
60851-34-5	2,3,4,6,7,8-HxCDF	1		1.054-1.426	1.22	10.0	ND	pg/L	U
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.58	10.0	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1		1.054-1.426	1.47	10.0	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	1.42	10.0	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1		1.054-1.426	1.56	10.0	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1		0.893-1.208	1.18	20.0	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	1.64	10.0	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1	2.310	0.893-1.208	1.55	10.0	2.91	pg/L	EMPC, J
39001-02-0	OCDF	1		0.757-1.024	2.36	20.0	ND	pg/L	U
3268-87-9	OCDD	1	1.474	0.757-1.024	2.41	50.0	5.59	pg/L	EMPC, J, B

Homologue Groups

55722-27-5	Total TCDF	1	0.000			10.0	ND	pg/L
41903-57-5	Total TCDD	1	0.000			10.0	ND	pg/L
30402-15-4	Total PeCDF	1	0.000			10.0	ND	pg/L
36088-22-9	Total PeCDD	1	0.000			10.0	ND	pg/L
55684-94-1	Total HxCDF	1	0.000			10.0	ND	pg/L
34465-46-8	Total HxCDD	1	0.000			10.0	ND	pg/L
38998-75-3	Total HpCDF	1	0.000			10.0	ND	pg/L
37871-00-4	Total HpCDD	1	0.000			10.0	ND	pg/L

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.295

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 2.15

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MW-C1-VB1-032422-D

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-12	File ID:	22040820
Sampled:	03/24/22 12:37	Prepared:	04/02/22 06:55	Analyzed:	04/09/22 02:35
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1000 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.778	0.655-0.886	1.83	93.7	24 - 169 %	
13C12-2,3,7,8-TCDD		0.757	0.655-0.886	1.99	105	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.566	1.318-1.783	2.51	91.4	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.629	1.318-1.783	2.65	95.4	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.609	1.318-1.783	2.26	93.3	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.503	0.434-0.587	3.25	98.0	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.501	0.434-0.587	3.05	98.5	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.498	0.434-0.587	3.48	96.9	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.509	0.434-0.587	4.05	99.5	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.265	1.054-1.426	2.97	96.4	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.202	1.054-1.426	2.71	101	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.476	0.374-0.506	4.10	90.1	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.442	0.374-0.506	5.30	94.4	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		1.074	0.893-1.208	4.66	96.2	23 - 140 %	
13C12-OCDD		0.849	0.757-1.024	5.23	99.5	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		0.79	103	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-C1-VB2-032422

Form 1
ORGANIC ANALYSIS DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-15 B	File ID:	22040821
Sampled:	03/24/22 10:30	Prepared:	04/02/22 06:55	Analyzed:	04/09/22 03:23
% Solids:	N/A	Preparation:	EPA 1613	Initial/Final:	1060 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1		0.655-0.886	0.77	9.43	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1		0.655-0.886	1.09	9.43	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1	1.362	1.318-1.783	0.98	9.43	0.83	pg/L	J
57117-31-4	2,3,4,7,8-PeCDF	1		1.318-1.783	0.90	9.43	ND	pg/L	U
40321-76-4	1,2,3,7,8-PeCDD	1		1.318-1.783	1.41	9.43	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1		1.054-1.426	1.17	9.43	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1		1.054-1.426	1.15	9.43	ND	pg/L	U
60851-34-5	2,3,4,6,7,8-HxCDF	1		1.054-1.426	1.14	9.43	ND	pg/L	U
72918-21-9	1,2,3,7,8,9-HxCDF	1		1.054-1.426	1.48	9.43	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1		1.054-1.426	1.24	9.43	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1		1.054-1.426	1.19	9.43	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1		1.054-1.426	1.31	9.43	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1		0.893-1.208	0.84	18.9	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1		0.893-1.208	1.23	9.43	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1		0.893-1.208	2.02	9.43	ND	pg/L	U
39001-02-0	OCDF	1		0.757-1.024	2.61	18.9	ND	pg/L	U
3268-87-9	OCDD	1	0.797	0.757-1.024	2.23	47.2	8.71	pg/L	J, B

Homologue Groups

55722-27-5	Total TCDF	1	0.000			9.43	ND	pg/L
41903-57-5	Total TCDD	1	0.000			9.43	ND	pg/L
30402-15-4	Total PeCDF	1	0.000			9.43	0.83	pg/L
36088-22-9	Total PeCDD	1	0.000			9.43	ND	pg/L
55684-94-1	Total HxCDF	1	0.000			9.43	ND	pg/L
34465-46-8	Total HxCDD	1	0.000			9.43	ND	pg/L
38998-75-3	Total HpCDF	1	0.000			9.43	ND	pg/L
37871-00-4	Total HpCDD	1	0.000			9.43	ND	pg/L

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.028

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 1.91

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MW-C1-VB2-032422

Form 2

ORGANIC ANALYSIS DATA SHEET

EPA 1613B

Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	22C0456-15	File ID:	22040821
Sampled:	03/24/22 10:30	Prepared:	04/02/22 06:55	Analyzed:	04/09/22 03:23
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1060 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF		0.776	0.655-0.886	1.39	80.7	24 - 169 %	
13C12-2,3,7,8-TCDD		0.757	0.655-0.886	1.66	92.0	25 - 164 %	
13C12-1,2,3,7,8-PeCDF		1.570	1.318-1.783	1.85	84.1	24 - 185 %	
13C12-2,3,4,7,8-PeCDF		1.554	1.318-1.783	1.96	82.6	21 - 178 %	
13C12-1,2,3,7,8-PeCDD		1.610	1.318-1.783	2.00	84.8	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF		0.505	0.434-0.587	3.32	82.8	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF		0.498	0.434-0.587	3.11	83.3	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF		0.504	0.434-0.587	3.55	82.7	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF		0.495	0.434-0.587	4.13	87.2	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD		1.253	1.054-1.426	3.13	82.3	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD		1.280	1.054-1.426	2.86	80.2	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF		0.466	0.374-0.506	2.92	80.5	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF		0.451	0.374-0.506	3.78	79.0	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD		1.065	0.893-1.208	3.75	82.2	23 - 140 %	
13C12-OCDD		0.932	0.757-1.024	5.01	81.2	17 - 157 %	
37Cl4-2,3,7,8-TCDD		328.000		0.66	87.2	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

PREPARATION BATCH SUMMARY

EPA 1613B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Batch: BKC0836 Batch Matrix: Water
Preparation: EPA 1613

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
MW-CP1-032322	22C0456-01	22040807	04/02/22 06:55	
MW-CP1-032322-D	22C0456-02	22040808	04/02/22 06:55	
MW-CP2-032322	22C0456-03	22040809	04/02/22 06:55	
MW-CP3-032322	22C0456-04	22040810	04/02/22 06:55	
MW-CP4-032322	22C0456-05	22040811	04/02/22 06:55	
MW-CP5-032322	22C0456-06	22040812	04/02/22 06:55	
MW-CP6-032322	22C0456-07	22040813	04/02/22 06:55	
MW-CP7-032322	22C0456-08	22040816	04/02/22 06:55	
MW-VB3-032322	22C0456-09	22040817	04/02/22 06:55	
HCOO-B312-032322	22C0456-10	22040818	04/02/22 06:55	
MW-C1-VB1-032422	22C0456-11	22040819	04/02/22 06:55	
MW-C1-VB1-032422-D	22C0456-12	22040820	04/02/22 06:55	
MW-C1-VB2-032422	22C0456-15	22040821	04/02/22 06:55	
Blank	BKC0836-BLK1	22040804	04/02/22 06:55	
LCS	BKC0836-BS1	22040805	04/02/22 06:55	
LCS Dup	BKC0836-BSD1	22040806	04/02/22 06:55	

Analytical Resources, LLC
Analytical Chemists and Consultants

HRGCMS Dioxin/Furan Preparation Bench Sheet EPA Methods 8290A & 1613B

Batch: BKC0836

Aqueous Samples

ARI Work Orders:	22C0456 , 22C0489	
Method (circle one)	Solid Phase Extraction	Separatory Funnel
Extraction Method	Start Date/Time:	End Date/Time:
Soxhlet / SepF Shake out	4/2/22 0655	4/2/22 0945
Tumble		

Reagents/Equipment Used	NA	ID / Lot Number	Initials	Date
~~Balance~~				
CH2Cl2		K0002394	M/DP	4/2/22/4/3/22
~~MeOH~~				
Hexane		K000 1327	DP	4/5/22
~~XAD-2~~				
~~H2SO4~~				
Na2SO4		K002960	M	4/2/22
Glasswool		I000679	M	4/6/22
Basic Silica		DP K000 2253	DP	4/7/22
Acid Silica		K002157	DP	4/7/22
0% Silica		K001436	DP	4/7/22
Activated Florisil		J000 85108	DP	4/7/22
Nonane		H000 6038	M	4/8/22
KI Strips		E001855	M	4/2/22
pH Paper		H000 7439	M	4/2/22
~~Other ( )~~				

Lab Number & Container	Sample Name	Sample Vol (mL) (Target)/Actual	pH >9 Adjust 7-9	Res Cl Check	RotoVap 45 °C	Final Vol (uL)
22C0456-01 B	MW-CP1-032322	(1,000.00) 1060	7	(P) / F	1 (2)	20
22C0456-02 B	MW-CP1-032322-D	(1,000.00) 1040	7	(P) / F	(1) 2	20
22C0456-03 B	MW-CP2-032322	(1,000.00) 1060	7	(P) / F	1 (2)	20
22C0456-04 B	MW-CP3-032322	(1,000.00) 910	7	(P) / F	(1) 2	20
22C0456-05 B	MW-CP4-032322	(1,000.00) 1055	7	(P) / F	1 (2)	20
22C0456-06 B	MW-CP5-032322	(1,000.00) 1018	7	(P) / F	(1) 2	20
22C0456-07 B	MW-CP6-032322	(1,000.00) 1027	7	(P) / F	1 (2)	20
22C0456-08 B	MW-CP7-032322	(1,000.00) 1053	7	(P) / F	(1) 2	20
22C0456-09 B	MW-VB3-032322	(1,000.00) 1030	7	(P) / F	1 (2)	20
22C0456-10 B	HCOO-B012-032322	(1,000.00) 1017	7	(P) / F	(1) 2	20
22C0456-11 B	MW-CI-VB1-032422	(1,000.00) 1000	7	(P) / F	1 (2)	20
22C0456-12 B	MW-CI-VB1-032422-D	(1,000.00) 1000	7	(P) / F	(1) 2	20
22C0456-15 B	MW-CI-VB2-032422	(1,000.00) 1060	7	(P) / F	1 (2)	20
22C0489-01 A	RP032422-11	(1,000.00) 1039	7	(P) / F	(1) 2	20
22C0489-02 A	RP032422-12	(1,000.00) 1053	7	(P) / F	1 (2)	20
22C0489-03 A	RP032422-13	(1,000.00) 1040	7	(P) / F	(1) 2	20
22C0489-06 A	RP032422-16	(1,000.00) 1010	7	(P) / F	1 (2)	20
BKC0836-BLK1	Blank	(1,000.00) ____	7	(P) / F	(1) 2	20
BKC0836-BS1	LCS	(1,000.00) ____	7	(P) / F	1 (2)	20
BKC0836-BSD1	LCS Dup	(1,000.00) ____	7	(P) / F	(1) 2	20
Prep Analyst / Date:		M 4/2/22	M 4/2/22	M 4/2/22	DP 4/8/22	M 4/8/22

4/8/22

Analytical Resources, LLC
Analytical Chemists and Consultants

HRGCMS Dioxin/Furan Preparation Bench Sheet EPA Methods 8290A & 1613B

Batch: BKC0836

Aqueous Samples

Standards Used	Vol	ID / Lot Number	Concentration	Expiration Date	Analyst	Witness	Date
Recovery Standard	1.0 mL	KBB1360	2/4 ng/mL	2/9/23	M	MX2	4/2/22
OPR	1.0 mL	JCB1326-1	0.2/1.0/2.0 ng/mL	12/15/22	M	MX2	4/2/22
~~QLS Standard~~	~~1.0 mL~~		~~0.01/0.05/0.1ng/mL ng/n~~				
Clean-up Standard	1.0 mL	KBB1361	0.8 ng/mL	2/9/23	DS	TW	4/7/22

Verify Client ID
Analyst / Date: M 4/2/22

Acid Clean
Y [N]
Analyst / Date:

Silica-Florisil Clean
[Y] N
Analyst / Date: DS 4/7/22

Supervisor Review By Date

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Organic Extractions Laboratory Analyst Notes

Extraction Parameter: Dioxin Extraction Batch BKC0489

Total Solids Batch: N/A Work Order(s): 22C0456, 22C0489

Screens: Soil/Sediment/Solid/Other:	Analyst/Date
☐ No Anomalies (standard soil/wet sediment/sand/gravel)=	
☐ Standing Water Decanted (Not shared)=	
☐ Standing Water Homogenized (Shared samples)=	
☐ Clay/Clumps (Difficult to homogenize)=	
☐ Rocks (%+size)?	
☐ Organics (Leaves/sticks/grass)=	
☐ Oily, obvious fuel/sulfur odors=	
☐ Received in 32oz jar(s)=Homogenized in Pyrex dish=	
☐ Previously Frozen =	
☐ Other (Details)=	
Aqueous:	
☒ No Anomalies 22C0456-01B-05B, 08B-12B, 22C0489-01A, 03A	M 4/2/22
☒ Turbid/Color= 06B: Tan turbid, 07B: slightly tan, turbid, 15B: slightly tan, clear.	M 4/2/22
☐ ~~Particulates(%)=(Note: >5%=Notify Supervisor/Lead)~~ 22C0489-02A = Amber clear, 06A = Amber, turbid	M 4/2/22
☒ Emulsions (%)= 22C0298-02A = ~30% emulsion, samples centrifuged	A 4/2/22
☐ Oily, obvious fuel/sulfur odors=	
☐ Other (Details)=	
☐ Received in 1.0L Bottle(s)=No Bottle Rinse=	
☐ Other Notes/Comments= (Note problems, concerns, corrective actions).	
☐ Share Samples Y / N	
☐ Multiple Jars Y / N	
☐ Sample Pre-Screens indicate analyte activity=	
☐ Sample weights/volumes reduced based on Pre-Screen=	

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Dioxin Extraction Laboratory – Glassware

Batch ID: BKC0836 Work Order: 22C0456, 22C0489 Extraction Parameter: Dioxin ARI Analyst NL

ARI Sample ID	300 mL Flat Bottom	Small Soxhlet	Large Soxhlet	250 mL Beaker	Funnel	Column	Florisil Column	Turbo Tube	Sep Funnel	Erlenmeyer Flask	Centrifuge Bottle	Turbo-Vap	Vortex Mixer	Heating Mantle
BKC0836- BLK1	24				23	W-6	W-19	W-23	1	29		4	4	
BS1	1				24	W-22	W-32	W-41	38	30		4	4	
BSD1	2				21	W-28	W-15	W-44	2	26		4	4	
22C0456- 01B	30				12	W-14	W-3	W-40	16	11		4	4	
02B	5				9	W-11	W-21	W-35	13	19		4	4	
03B	22				15	W-29	W-16	W-28	6	16		4	4	
04B	18				#11	W-13	W-10	W-44	8	12		4	4	
05B	10				19	W-36	W-4	W-40	48	28		4	4	
06B	26				27	W-31	W-26	W-42	28	2		4	4	
07B	16				14	W-9	W-24	W-32	43	13		4	4	
08B	8				3	W-10	W-7	W-46	41	6		4	4	
09B	17				7	W-1	W-17	W-37	35	18		4	4	
10B	4				20	W-46	W-1	W-20	26	11		4	4	
11B	7				16	W-30	W-25	W-31	7	27		4	4	
12B	21				5	W-18	W-27	W-14	83	5		4	4	
15B	3				6	W-16	W-2	W-2	40	51		4	4	
22C0489- 01A	29				1	W-34	W-5	W-27	15	2		4	4	
02A	19				30	W-35	W-14	W-24	55	48		4	4	
03A	28				17	W-5	W-28	W-47	17	3		4	4	
06A	4				52	W-32	W-18	W-39	37	1		4	4	
												4	4	
												4	4	
												4	4	

Analytical Resources, LLC
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CLEANUP BATCH SUMMARY

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Cleanup Batch:	CKD0049	Cleanup Type:	Silica Gel
Cleanup Method:	EPA 3630C Silica Gel Cleanup	Analysis:	EPA 1613B

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
MW-CP1-032322	22C0456-01	22040807	04/07/2022	
MW-VB3-032322	22C0456-09	22040817	04/07/2022	
MW-CP7-032322	22C0456-08	22040816	04/07/2022	
MW-CP6-032322	22C0456-07	22040813	04/07/2022	
MW-CP5-032322	22C0456-06	22040812	04/07/2022	
MW-CP4-032322	22C0456-05	22040811	04/07/2022	
MW-CP1-032322-D	22C0456-02	22040808	04/07/2022	
MW-CP2-032322	22C0456-03	22040809	04/07/2022	
MW-CP3-032322	22C0456-04	22040810	04/07/2022	
MW-C1-VB2-032422	22C0456-15	22040821	04/07/2022	
Blank	BKC0836-BLK1	22040804	04/07/2022	
LCS	BKC0836-BS1	22040805	04/07/2022	
LCS Dup	BKC0836-BSD1	22040806	04/07/2022	
MW-C1-VB1-032422-D	22C0456-12	22040820	04/07/2022	
MW-C1-VB1-032422	22C0456-11	22040819	04/07/2022	
HCOO-B312-032322	22C0456-10	22040818	04/07/2022	

Analytical Resources, LLC
Analytical Chemists and Consultants

CLEANUP BATCH SUMMARY

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Cleanup Batch:	CKD0050	Cleanup Type:	Florisil
Cleanup Method:	EPA 3620B Florisil Cleanup (uL)	Analysis:	EPA 1613B

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
MW-CP4-032322	22C0456-05	22040811	04/07/2022	
HCOO-B312-032322	22C0456-10	22040818	04/07/2022	
MW-C1-VB1-032422-D	22C0456-12	22040820	04/07/2022	
LCS Dup	BKC0836-BSD1	22040806	04/07/2022	
MW-CP1-032322	22C0456-01	22040807	04/07/2022	
MW-CP1-032322-D	22C0456-02	22040808	04/07/2022	
MW-C1-VB2-032422	22C0456-15	22040821	04/07/2022	
MW-CP3-032322	22C0456-04	22040810	04/07/2022	
MW-C1-VB1-032422	22C0456-11	22040819	04/07/2022	
MW-CP5-032322	22C0456-06	22040812	04/07/2022	
MW-CP6-032322	22C0456-07	22040813	04/07/2022	
MW-CP7-032322	22C0456-08	22040816	04/07/2022	
MW-VB3-032322	22C0456-09	22040817	04/07/2022	
Blank	BKC0836-BLK1	22040804	04/07/2022	
LCS	BKC0836-BS1	22040805	04/07/2022	
MW-CP2-032322	22C0456-03	22040809	04/07/2022	

Analytical Resources, LLC
Analytical Chemists and Consultants

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Form 1
METHOD BLANK DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	BKC0836-BLK1	File ID:	22040804
Sampled:	N/A	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 13:40
Solids Wt%:		Preparation:	EPA 1613	Initial/Final:	1000 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

CAS NO.	COMPOUND	DF/Split	Ion Ratio	Ratio Limits	EDL	RL	Result	Units	Q
51207-31-9	2,3,7,8-TCDF	1	0.000	0.655-0.886	1.32	10.0	ND	pg/L	U
1746-01-6	2,3,7,8-TCDD	1	0.000	0.655-0.886	1.60	10.0	ND	pg/L	U
57117-41-6	1,2,3,7,8-PeCDF	1	0.000	1.318-1.783	1.37	10.0	ND	pg/L	U
57117-31-4	2,3,4,7,8-PeCDF	1	0.000	1.318-1.783	1.28	10.0	ND	pg/L	U
40321-76-4	1,2,3,7,8-PeCDD	1	0.000	1.318-1.783	1.89	10.0	ND	pg/L	U
70648-26-9	1,2,3,4,7,8-HxCDF	1	0.000	1.054-1.426	1.26	10.0	ND	pg/L	U
57117-44-9	1,2,3,6,7,8-HxCDF	1	0.000	1.054-1.426	1.20	10.0	ND	pg/L	U
60851-34-5	2,3,4,6,7,8-HxCDF	1	0.000	1.054-1.426	1.26	10.0	ND	pg/L	U
72918-21-9	1,2,3,7,8,9-HxCDF	1	0.000	1.054-1.426	1.53	10.0	ND	pg/L	U
39227-28-6	1,2,3,4,7,8-HxCDD	1	0.000	1.054-1.426	1.65	10.0	ND	pg/L	U
57653-85-7	1,2,3,6,7,8-HxCDD	1	0.000	1.054-1.426	1.59	10.0	ND	pg/L	U
19408-74-3	1,2,3,7,8,9-HxCDD	1	0.000	1.054-1.426	1.75	10.0	ND	pg/L	U
67562-39-4	1,2,3,4,6,7,8-HpCDF	1	0.000	0.893-1.208	1.40	20.0	ND	pg/L	U
55673-89-7	1,2,3,4,7,8,9-HpCDF	1	0.000	0.893-1.208	2.00	10.0	ND	pg/L	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	1	0.000	0.893-1.208	1.81	10.0	ND	pg/L	U
39001-02-0	OCDF	1	0.000	0.757-1.024	2.68	20.0	ND	pg/L	U
3268-87-9	OCDD	1	0.996	0.757-1.024	2.43	50.0	8.29	pg/L	J

Homologue Groups

55722-27-5	Total TCDF	1	0.000			10.0	ND	pg/L
41903-57-5	Total TCDD	1	0.000			10.0	ND	pg/L
30402-15-4	Total PeCDF	1	0.000			10.0	ND	pg/L
36088-22-9	Total PeCDD	1	0.000			10.0	ND	pg/L
55684-94-1	Total HxCDF	1	0.000			10.0	ND	pg/L
34465-46-8	Total HxCDD	1	0.000			10.0	ND	pg/L
38998-75-3	Total HpCDF	1	0.000			10.0	ND	pg/L
37871-00-4	Total HpCDD	1	0.000			10.0	ND	pg/L

Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=0, Including EMPC): 0.002
Total 2,3,7,8-TCDD Equivalence (WHO2005, ND=1/2 EDL, Including EMPC): 2.56

Analytical Resources, Incorporated
Analytical Chemists and Consultants

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Form 2
METHOD BLANK DATA SHEET
EPA 1613B
Dioxins/Furans by HRGC/HRMS

Laboratory:	Analytical Resources, LLC			SDG:	22C0456
Client:	Floyd - Snider			Project:	Lora Lake 2021-2023 sec II. 5.3.2
Matrix:	Water	Laboratory ID:	BKC0836-BLK1	File ID:	22040804
Sampled:	N/A	Prepared:	04/02/22 06:55	Analyzed:	04/08/22 13:40
Solids Wt%:	N/A	Preparation:	EPA 1613	Initial/Final:	1000 mL / 20 uL
Result Basis:	Wet	Sequence:	SKD0114	Calibration:	FC00062
Batch:	BKC0836	Instrument:	AUTOSPEC01	Column:	RTX-Dioxin2

Labels	DF/Split	Ion Ratio	Ratio Limits	EDL	% REC	QC LIMITS	Q
13C12-2,3,7,8-TCDF	1	0.790	0.655-0.886	0.00	96.2	24 - 169 %	
13C12-2,3,7,8-TCDD	1	0.784	0.655-0.886	0.00	108	25 - 164 %	
13C12-1,2,3,7,8-PeCDF	1	1.546	1.318-1.783	0.00	96.9	24 - 185 %	
13C12-2,3,4,7,8-PeCDF	1	1.619	1.318-1.783	0.00	97.9	21 - 178 %	
13C12-1,2,3,7,8-PeCDD	1	1.552	1.318-1.783	0.00	101	25 - 181 %	
13C12-1,2,3,4,7,8-HxCDF	1	0.511	0.434-0.587	0.00	96.6	26 - 152 %	
13C12-1,2,3,6,7,8-HxCDF	1	0.501	0.434-0.587	0.00	97.3	26 - 123 %	
13C12-2,3,4,6,7,8-HxCDF	1	0.507	0.434-0.587	0.00	96.4	28 - 136 %	
13C12-1,2,3,7,8,9-HxCDF	1	0.491	0.434-0.587	0.00	103	29 - 147 %	
13C12-1,2,3,4,7,8-HxCDD	1	1.274	1.054-1.426	0.00	96.6	32 - 141 %	
13C12-1,2,3,6,7,8-HxCDD	1	1.275	1.054-1.426	0.00	97.4	28 - 130 %	
13C12-1,2,3,4,6,7,8-HpCDF	1	0.446	0.374-0.506	0.00	93.9	28 - 143 %	
13C12-1,2,3,4,7,8,9-HpCDF	1	0.445	0.374-0.506	0.00	98.5	26 - 138 %	
13C12-1,2,3,4,6,7,8-HpCDD	1	1.054	0.893-1.208	0.00	101	23 - 140 %	
13C12-OCDD	1	0.895	0.757-1.024	0.01	106	17 - 157 %	
37Cl4-2,3,7,8-TCDD	1	328.000		0.00	107	35 - 197 %	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

LCS RECOVERY
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Matrix:	Water	Analyzed:	04/08/22 14:28
Batch:	BKC0836	Laboratory ID:	BKC0836-BS1
Preparation:	EPA 1613	Sequence Name:	LCS
Initial/Final:	1000 mL / 20 uL		

COMPOUND	SPIKE ADDED (pg/L)	LCS CONCENTRATION (pg/L)	Q	LCS % REC. #	QC LIMITS REC.
2,3,7,8-TCDF	200	204		102	75 - 158
2,3,7,8-TCDD	200	192		95.9	67 - 158
1,2,3,7,8-PeCDF	1000	998		99.8	80 - 134
2,3,4,7,8-PeCDF	1000	1010		101	68 - 160
1,2,3,7,8-PeCDD	1000	1050		105	70 - 142
1,2,3,4,7,8-HxCDF	1000	1040		104	72 - 134
1,2,3,6,7,8-HxCDF	1000	1060		106	84 - 130
2,3,4,6,7,8-HxCDF	1000	1030		103	70 - 156
1,2,3,7,8,9-HxCDF	1000	1030		103	78 - 130
1,2,3,4,7,8-HxCDD	1000	1020		102	70 - 164
1,2,3,6,7,8-HxCDD	1000	983		98.3	76 - 134
1,2,3,7,8,9-HxCDD	1000	1020		102	64 - 162
1,2,3,4,6,7,8-HpCDF	1000	1020		102	82 - 122
1,2,3,4,7,8,9-HpCDF	1000	989		98.9	78 - 138
1,2,3,4,6,7,8-HpCDD	1000	1050		105	70 - 140
OCDF	2000	1710		85.7	63 - 170
OCDD	2000	1880	B	94.2	78 - 144

* Indicates values outside of QC limits

COMPOUND	SPIKE ADDED (pg/L)	LCSD CONCENTRATION (pg/L)	Q	LCSD % REC. #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
2,3,7,8-TCDF	200	200		99.9	2.26	25	75 - 158
2,3,7,8-TCDD	200	194		97.0	1.16	25	67 - 158
1,2,3,7,8-PeCDF	1000	993		99.3	0.509	25	80 - 134
2,3,4,7,8-PeCDF	1000	978		97.8	2.72	25	68 - 160
1,2,3,7,8-PeCDD	1000	1060		106	0.495	25	70 - 142
1,2,3,4,7,8-HxCDF	1000	1020		102	1.84	25	72 - 134
1,2,3,6,7,8-HxCDF	1000	1040		104	1.98	25	84 - 130
2,3,4,6,7,8-HxCDF	1000	998		99.8	3.53	25	70 - 156
1,2,3,7,8,9-HxCDF	1000	1030		103	0.407	25	78 - 130
1,2,3,4,7,8-HxCDD	1000	1020		102	0.535	25	70 - 164

* Indicates values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

LCS DUPLICATE RECOVERY/RPD
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Matrix:	Water	Analyzed:	04/08/22 15:16
Batch:	BKC0836	Laboratory ID:	BKC0836-BSD1
Preparation:	EPA 1613	Sequence Name:	LCS Dup
Initial/Final:	1000 mL / 20 uL		

COMPOUND	SPIKE ADDED (pg/L)	LCSD CONCENTRATION (pg/L)	Q	LCSD % REC. #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
1,2,3,6,7,8-HxCDD	1000	997		99.7	1.39	25	76 - 134
1,2,3,7,8,9-HxCDD	1000	1030		103	0.705	25	64 - 162
1,2,3,4,6,7,8-HpCDF	1000	986		98.6	3.16	25	82 - 122
1,2,3,4,7,8,9-HpCDF	1000	991		99.1	0.214	25	78 - 138
1,2,3,4,6,7,8-HpCDD	1000	958		95.8	9.08	25	70 - 140
OCDF	2000	1660		83.2	3.01	25	63 - 170
OCDD	2000	1850	B	92.3	2.12	25	78 - 144

* Indicates values outside of QC limits

Analytical Resources, LLC
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INITIAL CALIBRATION DATA
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Calibration:	FC00062	Instrument:	AUTOSPEC01
Calibration Date:	03/23/2022	Column (1):	RTX-Dioxin2

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
	Conc	RRF	Conc	RRF	Conc	RRF	Conc	RRF	Conc	RRF	Conc	RRF
2,3,7,8-TCDF			0.5	0.9637162	2	1.015644	10	0.9916337	40	0.9658295	200	0.986679
2,3,7,8-TCDD			0.5	1.255829	2	1.147744	10	1.07924	40	1.169757	200	1.186909
1,2,3,7,8-PeCDF	0.5	0.90743	2.5	0.9203157	10	0.8762971	50	0.9009024	200	0.9094881	1000	0.9192127
2,3,4,7,8-PeCDF	0.5	1.102915	2.5	1.00137	10	0.9832538	50	0.9606277	200	0.9875864	1000	1.009531
1,2,3,7,8-PeCDD	0.5	1.139582	2.5	1.139669	10	1.154561	50	1.164195	200	1.148213	1000	1.164707
1,2,3,4,7,8-HxCDF	0.5	1.101943	2.5	1.021312	10	1.034285	50	1.034282	200	1.036387	1000	1.044057
1,2,3,6,7,8-HxCDF	0.5	0.9378779	2.5	1.067899	10	1.025739	50	1.022493	200	1.036363	1000	1.026378
2,3,4,6,7,8-HxCDF	0.5	1.243336	2.5	1.098523	10	1.05323	50	1.063357	200	1.04721	1000	1.099998
1,2,3,7,8,9-HxCDF	0.5	1.144213	2.5	0.9266741	10	0.9535663	50	0.9862844	200	0.9697081	1000	0.9730174
1,2,3,4,7,8-HxCDD	0.5	0.9468227	2.5	0.9204612	10	0.9335842	50	0.9307683	200	0.9299661	1000	0.9420909
1,2,3,6,7,8-HxCDD	0.5	0.9668344	2.5	0.8371198	10	0.9827417	50	1.001829	200	0.9489363	1000	0.964721
1,2,3,7,8,9-HxCDD	0.5	0.9185552	2.5	0.8005933	10	0.8937062	50	0.8557187	200	0.8705659	1000	0.9021031
1,2,3,4,6,7,8-HpCDF	0.5	1.355939	2.5	1.185939	10	1.229098	50	1.190595	200	1.247265	1000	1.250453
1,2,3,4,7,8,9-HpCDF	0.5	1.245596	2.5	1.064446	10	1.189338	50	1.272289	200	1.187504	1000	1.193357
1,2,3,4,6,7,8-HpCDD	0.5	1.392898	2.5	1.298817	10	1.186511	50	1.209671	200	1.283217	1000	1.237548
OCDF	1	1.343362	5	1.313106	20	1.286028	100	1.221583	400	1.31391	2000	1.339322
OCDD			5	1.164481	20	1.084482	100	1.074982	400	1.05666	2000	1.065749
13C12-2,3,7,8-TCDF	100	1.739509	100	1.665883	100	1.725032	100	1.709088	100	1.806949	100	1.861871
13C12-2,3,7,8-TCDD	100	1.046454	100	1.031986	100	1.058097	100	1.129263	100	1.076662	100	1.145971
13C12-1,2,3,7,8-PeCDF	100	1.411277	100	1.327848	100	1.394647	100	1.387483	100	1.469082	100	1.660222
13C12-2,3,4,7,8-PeCDF	100	1.295623	100	1.259189	100	1.325419	100	1.330355	100	1.403424	100	1.580567
13C12-1,2,3,7,8-PeCDD	100	0.7461825	100	0.719498	100	0.7490906	100	0.7483488	100	0.7979726	100	0.8971815
13C12-1,2,3,4,7,8-HxCDF	100	1.100716	100	1.08919	100	1.092494	100	1.123218	100	1.104458	100	1.058628
13C12-1,2,3,6,7,8-HxCDF	100	1.173245	100	1.15071	100	1.165367	100	1.207758	100	1.178363	100	1.130592
13C12-2,3,4,6,7,8-HxCDF	100	1.008641	100	1.000944	100	1.017807	100	1.035996	100	1.06712	100	1.006736
13C12-1,2,3,7,8,9-HxCDF	100	0.8465629	100	0.8609997	100	0.8742316	100	0.8777903	100	0.9145932	100	0.8983098
13C12-1,2,3,4,7,8-HxCDD	100	0.9843949	100	0.9844106	100	0.9544472	100	0.980243	100	0.9919277	100	0.9541087
13C12-1,2,3,6,7,8-HxCDD	100	1.079961	100	1.110466	100	1.087945	100	1.054972	100	1.059159	100	1.006567

Analytical Resources, LLC
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Calibration:	FC00062	Instrument:	AUTOSPEC01
Calibration Date:	03/23/2022	Column (1):	RTX-Dioxin2

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
	Conc	RRF	Conc	**RRF**	Conc	RRF	Conc	RRF	Conc	**RRF**	Conc	**RRF**
13C12-1,2,3,4,6,7,8-HpCDF	100	0.8848214	100	0.9021607	100	0.9602943	100	0.9452988	100	0.9320491	100	0.9282932
13C12-1,2,3,4,7,8,9-HpCDF	100	0.6638638	100	0.6979426	100	0.7089863	100	0.6920329	100	0.7647477	100	0.7617052
13C12-1,2,3,4,6,7,8-HpCDD	100	0.5718604	100	0.566726	100	0.5787793	100	0.5903204	100	0.5866903	100	0.5953127
13C12-OCDD	200	0.4953552	200	0.4548763	200	0.4868895	200	0.5134434	200	0.5322678	200	0.568517
37Cl4-2,3,7,8-TCDD	0.1	1.140006	0.5	1.172762	2	1.07291	10	1.09879	40	1.073551	200	1.1626
13C12-1,2,3,4-TCDD	100	1	100	1	100	1	100	1	100	1	100	1
13C12-1,2,3,7,8,9-HxCDD	100	1	100	1	100	1	100	1	100	1	100	1

Analytical Resources, LLC
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Calibration:	FC00062	Instrument:	AUTOSPEC01
Calibration Date:	03/23/2022	Column (1):	RTX-Dioxin2

COMPOUND	Mean RRF	RRF RSD	Linear COD	Quad COD	Limit Type & Limit	Q
2,3,7,8-TCDF	0.9847005	2.2			RSD ()	
2,3,7,8-TCDD	1.167896	5.5			RSD ()	
1,2,3,7,8-PeCDF	0.9056077	1.8			RSD ()	
2,3,4,7,8-PeCDF	1.007547	4.9			RSD ()	
1,2,3,7,8-PeCDD	1.151821	1.0			RSD ()	
1,2,3,4,7,8-HxCDF	1.045378	2.7			RSD ()	
1,2,3,6,7,8-HxCDF	1.019458	4.2			RSD ()	
2,3,4,6,7,8-HxCDF	1.100942	6.7			RSD ()	
1,2,3,7,8,9-HxCDF	0.9922439	7.8			RSD ()	
1,2,3,4,7,8-HxCDD	0.9339489	1.0			RSD ()	
1,2,3,6,7,8-HxCDD	0.9503637	6.1			RSD ()	
1,2,3,7,8,9-HxCDD	0.8735404	4.8			RSD ()	
1,2,3,4,6,7,8-HpCDF	1.243215	5.0			RSD ()	
1,2,3,4,7,8,9-HpCDF	1.192088	6.0			RSD ()	
1,2,3,4,6,7,8-HpCDD	1.26811	5.9			RSD ()	
OCDF	1.302885	3.4			RSD ()	
OCDD	1.089271	4.0			RSD ()	
13C12-2,3,7,8-TCDF	1.751389	4.1			RSD ()	
13C12-2,3,7,8-TCDD	1.081405	4.3			RSD ()	
13C12-1,2,3,7,8-PeCDF	1.44176	8.1			RSD ()	
13C12-2,3,4,7,8-PeCDF	1.365763	8.5			RSD ()	
13C12-1,2,3,7,8-PeCDD	0.776379	8.3			RSD ()	
13C12-1,2,3,4,7,8-HxCDF	1.094784	2.0			RSD ()	
13C12-1,2,3,6,7,8-HxCDF	1.167672	2.2			RSD ()	
13C12-2,3,4,6,7,8-HxCDF	1.022874	2.4			RSD ()	
13C12-1,2,3,7,8,9-HxCDF	0.8787479	2.8			RSD ()	
13C12-1,2,3,4,7,8-HxCDD	0.974922	1.7			RSD ()	
13C12-1,2,3,6,7,8-HxCDD	1.066512	3.3			RSD ()	
13C12-1,2,3,4,6,7,8-HpCDF	0.9254863	3.0			RSD ()	
13C12-1,2,3,4,7,8,9-HpCDF	0.7148797	5.6			RSD ()	
13C12-1,2,3,4,6,7,8-HpCDD	0.5816149	1.9			RSD ()	

Analytical Resources, LLC
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Calibration:	FC00062	Instrument:	AUTOSPEC01
Calibration Date:	03/23/2022	Column (1):	RTX-Dioxin2

COMPOUND	Mean RRF	RRF RSD	Linear COD	Quad COD	Limit Type & Limit	Q
13C12-OCDD	0.5085582	7.7			RSD ()	
37Cl4-2,3,7,8-TCDD	1.120103	4.0			RSD ()	
13C12-1,2,3,4-TCDD	1	0.0			RSD ()	
13C12-1,2,3,7,8,9-HxCDD	1	0.0			RSD ()	

Analytical Resources, LLC
Analytical Chemists and Consultants

SECOND-SOURCE CALIBRATION VERIFICATION

EPA 1613B

Laboratory: Analytical Resources, LLC
Client: Floyd - Snider
Calibration: FC00062
Sequence: SKC0306

SDG: 22C0456
Project: Lora Lake 2021-2023 sec II. 5.3.21
Laboratory ID: SKC0306-SCV1
Sequence Name: ICVCH
Standard ID: G001361

ANALYTE	EXPECTED (ng/mL)	FOUND (ng/mL)	% DRIFT	QC LIMIT
2,3,7,8-TCDF	10.000	10.6	5.8	
2,3,7,8-TCDD	10.000	11.7	16.8	
1,2,3,7,8-PeCDF	50.000	53.1	6.3	
2,3,4,7,8-PeCDF	50.000	48.6	-2.8	
1,2,3,7,8-PeCDD	50.000	55.1	10.1	
1,2,3,4,7,8-HxCDF	50.000	53.4	6.7	
1,2,3,6,7,8-HxCDF	50.000	54.5	9.0	
2,3,4,6,7,8-HxCDF	50.000	53.7	7.3	
1,2,3,7,8,9-HxCDF	50.000	54.7	9.4	
1,2,3,4,7,8-HxCDD	50.000	57.2	14.5	
1,2,3,6,7,8-HxCDD	50.000	52.2	4.4	
1,2,3,7,8,9-HxCDD	50.000	52.6	5.2	
1,2,3,4,6,7,8-HpCDF	50.000	56.3	12.7	
1,2,3,4,7,8,9-HpCDF	50.000	59.5	19.0	
1,2,3,4,6,7,8-HpCDD	50.000	55.0	9.9	
OCDF	100.00	108	8.3	
OCDD	100.00	111	10.7	
13C12-2,3,7,8-TCDF	100.00	102	1.8	
13C12-2,3,7,8-TCDD	100.00	82.0	-18.0	
13C12-1,2,3,7,8-PeCDF	100.00	104	4.2	
13C12-2,3,4,7,8-PeCDF	100.00	107	7.2	
13C12-1,2,3,7,8-PeCDD	100.00	97.8	-2.2	
13C12-1,2,3,4,7,8-HxCDF	100.00	118	18.2	
13C12-1,2,3,6,7,8-HxCDF	100.00	123	23.4	
13C12-2,3,4,6,7,8-HxCDF	100.00	112	12.1	
13C12-1,2,3,7,8,9-HxCDF	100.00	116	15.5	
13C12-1,2,3,4,7,8-HxCDD	100.00	115	14.8	
13C12-1,2,3,6,7,8-HxCDD	100.00	119	18.9	
13C12-1,2,3,4,6,7,8-HpCDF	100.00	121	20.6	
13C12-1,2,3,4,7,8,9-HpCDF	100.00	111	11.3	
13C12-1,2,3,4,6,7,8-HpCDD	100.00	111	11.0	
13C12-OCDD	200.00	217	8.5	
37Cl4-2,3,7,8-TCDD	10.000	10.5	5.3	

Analytical Resources, LLC
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SECOND-SOURCE CALIBRATION VERIFICATION

EPA 1613B

Laboratory:	Analytical Resources, LLC	**SDG:**	22C0456
Client:	Floyd - Snider	**Project:**	Lora Lake 2021-2023 sec II. 5.3.21
Calibration:	FC00062	**Laboratory ID:**	SKC0306-SCV1
Sequence:	SKC0306	**Sequence Name:**	ICVCH
		Standard ID:	G001361

* Indicates values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SECOND-SOURCE CALIBRATION VERIFICATION

EPA 1613B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Calibration: FC00062
Laboratory ID: SKC0306-SCV1
Sequence: SKC0306
Standard ID: G001361

ANALYTE	EXPECTED (ng/mL)	FOUND (ng/mL)	% DRIFT	QC LIMIT
OCDF	100.00	108	8.3	
OCDD	100.00	111	10.7	
13C12-2,3,7,8-TCDF	100.00	102	1.8	
13C12-2,3,7,8-TCDD	100.00	82.0	-18.0	
13C12-1,2,3,7,8-PeCDF	100.00	104	4.2	
13C12-2,3,4,7,8-PeCDF	100.00	107	7.2	
13C12-1,2,3,7,8-PeCDD	100.00	97.8	-2.2	
13C12-1,2,3,4,7,8-HxCDF	100.00	118	18.2	
13C12-1,2,3,6,7,8-HxCDF	100.00	123	23.4	
13C12-2,3,4,6,7,8-HxCDF	100.00	112	12.1	
13C12-1,2,3,7,8,9-HxCDF	100.00	116	15.5	
13C12-1,2,3,4,7,8-HxCDD	100.00	115	14.8	
13C12-1,2,3,6,7,8-HxCDD	100.00	119	18.9	
13C12-1,2,3,4,6,7,8-HpCDF	100.00	121	20.6	
13C12-1,2,3,4,7,8,9-HpCDF	100.00	111	11.3	
13C12-1,2,3,4,6,7,8-HpCDD	100.00	111	11.0	
13C12-OCDD	200.00	217	8.5	
37Cl4-2,3,7,8-TCDD	10.000	10.5	5.3	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

INITIAL CALIBRATION CHECK
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID:	AUTOSPEC01	Calibration:	FC00062
Lab File ID:	22032302	Calibration Date:	03/23/2022
Sequence:	SKC0306	Injection Date:	03/23/22
Lab Sample ID:	SKC0306-ICV1	Injection Time:	09:30
Sequence Name:	CS3H1		

		CONC. (ng/mL)		RESPONSE FACTOR			% DRIFT/DIFF	
COMPOUND	TYPE	STD	ICV	ICAL	ICV	MIN	ICV	LIMIT
2,3,7,8-TCDF	A	10.000	9.96	0.9847005	0.9809363		-0.4	+/-16
2,3,7,8-TCDD	A	10.000	9.28	1.1678960	1.0833780		-7.2	+/-22
1,2,3,7,8-PeCDF	A	50.000	49.5	0.9056077	0.8962046		-1.0	+/-18
2,3,4,7,8-PeCDF	A	50.000	49.2	1.0075470	0.9908089		-1.7	+/-18
1,2,3,7,8-PeCDD	A	50.000	49.4	1.1518210	1.1376960		-1.2	+/-22
1,2,3,4,7,8-HxCDF	A	50.000	49.9	1.0453780	1.0438810		-0.1	+/-10
1,2,3,6,7,8-HxCDF	A	50.000	53.7	1.0194580	1.0954640		7.5	+/-12
2,3,4,6,7,8-HxCDF	A	50.000	48.6	1.1009420	1.0707640		-2.7	+/-12
1,2,3,7,8,9-HxCDF	A	50.000	47.4	0.9922439	0.9414101		-5.1	+/-10
1,2,3,4,7,8-HxCDD	A	50.000	50.9	0.9339489	0.9506789		1.8	+/-22
1,2,3,6,7,8-HxCDD	A	50.000	50.3	0.9503637	0.9557980		0.6	+/-22
1,2,3,7,8,9-HxCDD	A	50.000	50.6	0.8735404	0.8833196		1.2	+/-18
1,2,3,4,6,7,8-HpCDF	A	50.000	49.4	1.2432150	1.2292090		-1.1	+/-10
1,2,3,4,7,8,9-HpCDF	A	50.000	54.1	1.1920880	1.2904670		8.3	+/-14
1,2,3,4,6,7,8-HpCDD	A	50.000	47.2	1.2681100	1.1964240		-5.7	+/-14
OCDF	A	100.00	94.5	1.3028850	1.2317270		-5.5	+/-37
OCDD	A	100.00	93.7	1.0892710	1.0202670		-6.3	+/-21
13C12-2,3,7,8-TCDF	A	100.00	95.8	1.7513890	1.6775571		-4.2	+/-29
13C12-2,3,7,8-TCDD	A	100.00	104	1.0814050	1.1218933		3.7	+/-18
13C12-1,2,3,7,8-PeCDF	A	100.00	96.3	1.4417600	1.3890290		-3.7	+/-24
13C12-2,3,4,7,8-PeCDF	A	100.00	95.7	1.3657630	1.3070074		-4.3	+/-23
13C12-1,2,3,7,8-PeCDD	A	100.00	100	0.7763790	0.7764987		0.02	+/-38
13C12-1,2,3,4,7,8-HxCDF	A	100.00	93.1	1.0947840	1.0188414		-6.9	+/-24
13C12-1,2,3,6,7,8-HxCDF	A	100.00	90.8	1.1676720	1.0599392		-9.2	+/-30
13C12-2,3,4,6,7,8-HxCDF	A	100.00	92.7	1.0228740	0.9477137		-7.3	+/-27
13C12-1,2,3,7,8,9-HxCDF	A	100.00	101	0.8787479	0.8903158		1.3	+/-26
13C12-1,2,3,4,7,8-HxCDD	A	100.00	96.1	0.9749220	0.9371180		-3.9	+/-15
13C12-1,2,3,6,7,8-HxCDD	A	100.00	95.7	1.0665120	1.0210363		-4.3	+/-15
13C12-1,2,3,4,6,7,8-HpCDF	A	100.00	94.8	0.9254863	0.8777404		-5.2	+/-22
13C12-1,2,3,4,7,8,9-HpCDF	A	100.00	96.4	0.7148797	0.6888273		-3.6	+/-23

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

INITIAL CALIBRATION CHECK
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID:	AUTOSPEC01	Calibration:	FC00062
Lab File ID:	22032302	Calibration Date:	03/23/2022
Sequence:	SKC0306	Injection Date:	03/23/22
Lab Sample ID:	SKC0306-ICV1	Injection Time:	09:30
Sequence Name:	CS3H1		

		CONC. (ng/mL)		RESPONSE FACTOR			% DRIFT/DIFF	
COMPOUND	TYPE	STD	ICV	ICAL	ICV	MIN	ICV	LIMIT
13C12-1,2,3,4,6,7,8-HpCDD	A	100.00	104	0.5816149	0.6064523		4.3	+/-28
13C12-OCDD	A	200.00	208	0.5085582	0.5280985		3.8	+/-52
37Cl4-2,3,7,8-TCDD	A	10.000	9.59	1.1201030	1.0736877		-4.1	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

INITIAL CALIBRATION CHECK
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID:	AUTOSPEC01	Calibration:	FC00062
Lab File ID:	22040802	Calibration Date:	03/23/2022
Sequence:	SKD0114	Injection Date:	04/08/22
Lab Sample ID:	SKD0114-ICV1	Injection Time:	11:57
Sequence Name:	CS3M1		

		CONC. (ng/mL)		RESPONSE FACTOR			% DRIFT/DIFF	
COMPOUND	TYPE	STD	ICV	ICAL	ICV	MIN	ICV	LIMIT
2,3,7,8-TCDF	A	10.000	9.54	0.9847005	0.9396065		-4.6	+/-16
2,3,7,8-TCDD	A	10.000	9.46	1.1678960	1.1043040		-5.4	+/-22
1,2,3,7,8-PeCDF	A	50.000	48.5	0.9056077	0.8783548		-3.0	+/-18
2,3,4,7,8-PeCDF	A	50.000	48.9	1.0075470	0.9846184		-2.3	+/-18
1,2,3,7,8-PeCDD	A	50.000	50.0	1.1518210	1.1527970		0.08	+/-22
1,2,3,4,7,8-HxCDF	A	50.000	49.9	1.0453780	1.0427790		-0.2	+/-10
1,2,3,6,7,8-HxCDF	A	50.000	50.1	1.0194580	1.0210310		0.2	+/-12
2,3,4,6,7,8-HxCDF	A	50.000	48.7	1.1009420	1.0713080		-2.7	+/-12
1,2,3,7,8,9-HxCDF	A	50.000	49.1	0.9922439	0.9737748		-1.9	+/-10
1,2,3,4,7,8-HxCDD	A	50.000	49.7	0.9339489	0.9274672		-0.7	+/-22
1,2,3,6,7,8-HxCDD	A	50.000	50.6	0.9503637	0.9612334		1.1	+/-22
1,2,3,7,8,9-HxCDD	A	50.000	53.0	0.8735404	0.9140774		5.9	+/-18
1,2,3,4,6,7,8-HpCDF	A	50.000	50.2	1.2432150	1.2492450		0.5	+/-10
1,2,3,4,7,8,9-HpCDF	A	50.000	51.3	1.1920880	1.2235860		2.6	+/-14
1,2,3,4,6,7,8-HpCDD	A	50.000	49.0	1.2681100	1.2414800		-2.1	+/-14
OCDF	A	100.00	89.2	1.3028850	1.1616340		-10.8	+/-37
OCDD	A	100.00	92.3	1.0892710	1.0055740		-7.7	+/-21
13C12-2,3,7,8-TCDF	A	100.00	104	1.7513890	1.8246476		4.2	+/-29
13C12-2,3,7,8-TCDD	A	100.00	111	1.0814050	1.1978387		10.8	+/-18
13C12-1,2,3,7,8-PeCDF	A	100.00	101	1.4417600	1.4522996		0.7	+/-24
13C12-2,3,4,7,8-PeCDF	A	100.00	99.7	1.3657630	1.3621422		-0.3	+/-23
13C12-1,2,3,7,8-PeCDD	A	100.00	105	0.7763790	0.8145750		4.9	+/-38
13C12-1,2,3,4,7,8-HxCDF	A	100.00	94.6	1.0947840	1.0354863		-5.4	+/-24
13C12-1,2,3,6,7,8-HxCDF	A	100.00	94.7	1.1676720	1.1058816		-5.3	+/-30
13C12-2,3,4,6,7,8-HxCDF	A	100.00	96.7	1.0228740	0.9891694		-3.3	+/-27
13C12-1,2,3,7,8,9-HxCDF	A	100.00	103	0.8787479	0.9086770		3.4	+/-26
13C12-1,2,3,4,7,8-HxCDD	A	100.00	97.0	0.9749220	0.9458350		-3.0	+/-15
13C12-1,2,3,6,7,8-HxCDD	A	100.00	94.2	1.0665120	1.0050728		-5.8	+/-15
13C12-1,2,3,4,6,7,8-HpCDF	A	100.00	92.4	0.9254863	0.8552435		-7.6	+/-22
13C12-1,2,3,4,7,8,9-HpCDF	A	100.00	96.2	0.7148797	0.6875193		-3.8	+/-23

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

INITIAL CALIBRATION CHECK
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID:	AUTOSPEC01	Calibration:	FC00062
Lab File ID:	22040802	Calibration Date:	03/23/2022
Sequence:	SKD0114	Injection Date:	04/08/22
Lab Sample ID:	SKD0114-ICV1	Injection Time:	11:57
Sequence Name:	CS3M1		

		CONC. (ng/mL)		RESPONSE FACTOR			% DRIFT/DIFF	
COMPOUND	TYPE	STD	ICV	ICAL	ICV	MIN	ICV	LIMIT
13C12-1,2,3,4,6,7,8-HpCDD	A	100.00	101	0.5816149	0.5894842		1.4	+/-18
13C12-OCDD	A	200.00	220	0.5085582	0.5592900		10.0	+/-52
37Cl4-2,3,7,8-TCDD	A	10.000	10.3	1.1201030	1.1485696		2.5	+/-21

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

CONTINUING CALIBRATION CHECK
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID:	AUTOSPEC01	Calibration:	FC00062
Lab File ID:	22032311	Calibration Date:	03/23/2022
Sequence:	SKC0306	Injection Date:	03/23/22
Lab Sample ID:	SKC0306-CCV1	Injection Time:	17:34
Sequence Name:	CS3H2		

		CONC. (ng/mL)		RESPONSE FACTOR (RRF)			% DRIFT/DIFF	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN	CCV	LIMIT
2,3,7,8-TCDF	A	10.000	10.2	0.9847005	1.0020020		1.8	+/-16
2,3,7,8-TCDD	A	10.000	9.53	1.1678960	1.1128040		-4.7	+/-22
1,2,3,7,8-PeCDF	A	50.000	50.3	0.9056077	0.9114834		0.6	+/-18
2,3,4,7,8-PeCDF	A	50.000	48.5	1.0075470	0.9781671		-2.9	+/-18
1,2,3,7,8-PeCDD	A	50.000	51.0	1.1518210	1.1752140		2.0	+/-22
1,2,3,4,7,8-HxCDF	A	50.000	49.7	1.0453780	1.0391680		-0.6	+/-10
1,2,3,6,7,8-HxCDF	A	50.000	53.3	1.0194580	1.0875140		6.7	+/-12
2,3,4,6,7,8-HxCDF	A	50.000	47.5	1.1009420	1.0448970		-5.1	+/-12
1,2,3,7,8,9-HxCDF	A	50.000	50.9	0.9922439	1.0092520		1.7	+/-10
1,2,3,4,7,8-HxCDD	A	50.000	51.7	0.9339489	0.9659074		3.4	+/-22
1,2,3,6,7,8-HxCDD	A	50.000	49.4	0.9503637	0.9396596		-1.1	+/-22
1,2,3,7,8,9-HxCDD	A	50.000	51.2	0.8735404	0.8938197		2.4	+/-18
1,2,3,4,6,7,8-HpCDF	A	50.000	50.5	1.2432150	1.2556780		1.0	+/-10
1,2,3,4,7,8,9-HpCDF	A	50.000	55.3	1.1920880	1.3196410		10.7	+/-14
1,2,3,4,6,7,8-HpCDD	A	50.000	50.5	1.2681100	1.2820410		1.1	+/-14
OCDF	A	100.00	101	1.3028850	1.3101160		0.6	+/-37
OCDD	A	100.00	97.2	1.0892710	1.0585940		-2.8	+/-21
13C12-2,3,7,8-TCDF	A	100.00	101	1.7513890	1.7612010		0.6	+/-29
13C12-2,3,7,8-TCDD	A	100.00	104	1.0814050	1.1241821		4.0	+/-18
13C12-1,2,3,7,8-PeCDF	A	100.00	100	1.4417600	1.4432897		0.1	+/-24
13C12-2,3,4,7,8-PeCDF	A	100.00	99.4	1.3657630	1.3569953		-0.6	+/-23
13C12-1,2,3,7,8-PeCDD	A	100.00	96.3	0.7763790	0.7479364		-3.7	+/-38
13C12-1,2,3,4,7,8-HxCDF	A	100.00	106	1.0947840	1.1573961		5.7	+/-24
13C12-1,2,3,6,7,8-HxCDF	A	100.00	105	1.1676720	1.2254406		4.9	+/-30
13C12-2,3,4,6,7,8-HxCDF	A	100.00	108	1.0228740	1.1073766		8.3	+/-27
13C12-1,2,3,7,8,9-HxCDF	A	100.00	105	0.8787479	0.9200826		4.7	+/-26
13C12-1,2,3,4,7,8-HxCDD	A	100.00	99.9	0.9749220	0.9734916		-0.1	+/-15
13C12-1,2,3,6,7,8-HxCDD	A	100.00	103	1.0665120	1.1004828		3.2	+/-15
13C12-1,2,3,4,6,7,8-HpCDF	A	100.00	108	0.9254863	1.0014791		8.2	+/-22
13C12-1,2,3,4,7,8,9-HpCDF	A	100.00	104	0.7148797	0.7442176		4.1	+/-23
13C12-1,2,3,4,6,7,8-HpCDD	A	100.00	104	0.5816149	0.6050627		4.0	+/-28
13C12-OCDD	A	200.00	212	0.5085582	0.5402455		6.2	+/-52
37Cl4-2,3,7,8-TCDD	A	10.000	9.61	1.1201030	1.0767516		-3.9	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SECOND-SOURCE
CONTINUING CALIBRATION CHECK
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID:	AUTOSPEC01	Calibration:	FC00062
Lab File ID:	22032310	Calibration Date:	03/23/2022
Sequence:	SKC0306	Injection Date:	03/23/22
Lab Sample ID:	SKC0306-SCV1	Injection Time:	16:46
Sequence Name:	ICVCH		

		CONC. (ng/mL)		RESPONSE FACTOR (RRF)			% DRIFT/DIFF	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN	CCV	LIMIT
2,3,7,8-TCDF	A	10.000	10.6	0.9847005	1.0420290		5.8	
2,3,7,8-TCDD	A	10.000	11.7	1.1678960	1.3643620		16.8	
1,2,3,7,8-PeCDF	A	50.000	53.1	0.9056077	0.9626373		6.3	
2,3,4,7,8-PeCDF	A	50.000	48.6	1.0075470	0.9798343		-2.8	
1,2,3,7,8-PeCDD	A	50.000	55.1	1.1518210	1.2683820		10.1	
1,2,3,4,7,8-HxCDF	A	50.000	53.4	1.0453780	1.1156160		6.7	
1,2,3,6,7,8-HxCDF	A	50.000	54.5	1.0194580	1.1110480		9.0	
2,3,4,6,7,8-HxCDF	A	50.000	53.7	1.1009420	1.1816960		7.3	
1,2,3,7,8,9-HxCDF	A	50.000	54.7	0.9922439	1.0852220		9.4	
1,2,3,4,7,8-HxCDD	A	50.000	57.2	0.9339489	1.0691520		14.5	
1,2,3,6,7,8-HxCDD	A	50.000	52.2	0.9503637	0.9921833		4.4	
1,2,3,7,8,9-HxCDD	A	50.000	52.6	0.8735404	7916.042		5.2	
1,2,3,4,6,7,8-HpCDF	A	50.000	56.3	1.2432150	1.4004930		12.7	
1,2,3,4,7,8,9-HpCDF	A	50.000	59.5	1.1920880	1.4190220		19.0	
1,2,3,4,6,7,8-HpCDD	A	50.000	55.0	1.2681100	1.3942330		9.9	
OCDF	A	100.00	108	1.3028850	1.4116330		8.3	
OCDD	A	100.00	111	1.0892710	1.2057030		10.7	
13C12-2,3,7,8-TCDF	A	100.00	102	1.7513890	1.7836445		1.8	
13C12-2,3,7,8-TCDD	A	100.00	82.0	1.0814050	0.8869403		-18.0	
13C12-1,2,3,7,8-PeCDF	A	100.00	104	1.4417600	1.5029657		4.2	
13C12-2,3,4,7,8-PeCDF	A	100.00	107	1.3657630	1.4640575		7.2	
13C12-1,2,3,7,8-PeCDD	A	100.00	97.8	0.7763790	0.7591495		-2.2	
13C12-1,2,3,4,7,8-HxCDF	A	100.00	118	1.0947840	1.2937706		18.2	
13C12-1,2,3,6,7,8-HxCDF	A	100.00	123	1.1676720	1.4406458		23.4	
13C12-2,3,4,6,7,8-HxCDF	A	100.00	112	1.0228740	1.1471395		12.1	
13C12-1,2,3,7,8,9-HxCDF	A	100.00	116	0.8787479	1.0151048		15.5	
13C12-1,2,3,4,7,8-HxCDD	A	100.00	115	0.9749220	1.1193836		14.8	
13C12-1,2,3,6,7,8-HxCDD	A	100.00	119	1.0665120	1.2678870		18.9	
13C12-1,2,3,4,6,7,8-HpCDF	A	100.00	121	0.9254863	1.1162468		20.6	
13C12-1,2,3,4,7,8,9-HpCDF	A	100.00	111	0.7148797	0.7959489		11.3	
13C12-1,2,3,4,6,7,8-HpCDD	A	100.00	111	0.5816149	0.6454744		11.0	
13C12-OCDD	A	200.00	217	0.5085582	0.5515879		8.5	
37Cl4-2,3,7,8-TCDD	A	10.000	10.5	1.1201030	1.1799099		5.3	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

CONTINUING CALIBRATION CHECK
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID:	AUTOSPEC01	Calibration:	FC00062
Lab File ID:	22040814	Calibration Date:	03/23/2022
Sequence:	SKD0114	Injection Date:	04/08/22
Lab Sample ID:	SKD0114-CCV1	Injection Time:	21:40
Sequence Name:	CS3M2		

		CONC. (ng/mL)		RESPONSE FACTOR (RRF)			% DRIFT/DIFF	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN	CCV	LIMIT
2,3,7,8-TCDF	A	10.000	9.60	0.9847005	0.9448955		-4.0	+/-16
2,3,7,8-TCDD	A	10.000	9.31	1.1678960	1.0874230		-6.9	+/-22
1,2,3,7,8-PeCDF	A	50.000	47.7	0.9056077	0.8646126		-4.5	+/-18
2,3,4,7,8-PeCDF	A	50.000	49.2	1.0075470	0.9917631		-1.6	+/-18
1,2,3,7,8-PeCDD	A	50.000	51.3	1.1518210	1.1817770		2.6	+/-22
1,2,3,4,7,8-HxCDF	A	50.000	50.5	1.0453780	1.0555470		1.0	+/-10
1,2,3,6,7,8-HxCDF	A	50.000	52.5	1.0194580	1.0699360		5.0	+/-12
2,3,4,6,7,8-HxCDF	A	50.000	49.9	1.1009420	1.0985150		-0.2	+/-12
1,2,3,7,8,9-HxCDF	A	50.000	49.5	0.9922439	0.9814199		-1.1	+/-10
1,2,3,4,7,8-HxCDD	A	50.000	48.7	0.9339489	0.9087543		-2.7	+/-22
1,2,3,6,7,8-HxCDD	A	50.000	49.0	0.9503637	0.9308148		-2.1	+/-22
1,2,3,7,8,9-HxCDD	A	50.000	51.2	0.8735404	0.8945103		2.5	+/-18
1,2,3,4,6,7,8-HpCDF	A	50.000	48.9	1.2432150	1.2152670		-2.2	+/-10
1,2,3,4,7,8,9-HpCDF	A	50.000	51.1	1.1920880	1.2178890		2.2	+/-14
1,2,3,4,6,7,8-HpCDD	A	50.000	50.8	1.2681100	1.2874970		1.5	+/-14
OCDF	A	100.00	90.4	1.3028850	1.1782730		-9.6	+/-37
OCDD	A	100.00	91.1	1.0892710	0.9922090		-8.9	+/-21
13C12-2,3,7,8-TCDF	A	100.00	104	1.7513890	1.8178042		3.8	+/-29
13C12-2,3,7,8-TCDD	A	100.00	114	1.0814050	1.2296401		13.7	+/-18
13C12-1,2,3,7,8-PeCDF	A	100.00	103	1.4417600	1.4852364		3.0	+/-24
13C12-2,3,4,7,8-PeCDF	A	100.00	99.9	1.3657630	1.3639797		-0.1	+/-23
13C12-1,2,3,7,8-PeCDD	A	100.00	103	0.7763790	0.8026743		3.4	+/-38
13C12-1,2,3,4,7,8-HxCDF	A	100.00	98.3	1.0947840	1.0759761		-1.7	+/-24
13C12-1,2,3,6,7,8-HxCDF	A	100.00	99.1	1.1676720	1.1574552		-0.9	+/-30
13C12-2,3,4,6,7,8-HxCDF	A	100.00	97.6	1.0228740	0.9981999		-2.4	+/-27
13C12-1,2,3,7,8,9-HxCDF	A	100.00	105	0.8787479	0.9243303		5.2	+/-26
13C12-1,2,3,4,7,8-HxCDD	A	100.00	99.5	0.9749220	0.9704202		-0.5	+/-15
13C12-1,2,3,6,7,8-HxCDD	A	100.00	98.1	1.0665120	1.0465505		-1.9	+/-15
13C12-1,2,3,4,6,7,8-HpCDF	A	100.00	95.4	0.9254863	0.8824820		-4.6	+/-22
13C12-1,2,3,4,7,8,9-HpCDF	A	100.00	101	0.7148797	0.7185103		0.5	+/-23
13C12-1,2,3,4,6,7,8-HpCDD	A	100.00	101	0.5816149	0.5885963		1.2	+/-18
13C12-OCDD	A	200.00	218	0.5085582	0.5546576		9.1	+/-52
37Cl4-2,3,7,8-TCDD	A	10.000	10.5	1.1201030	1.1752684		4.9	+/-21

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

CONTINUING CALIBRATION CHECK
EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID:	AUTOSPEC01	Calibration:	FC00062
Lab File ID:	22040826	Calibration Date:	03/23/2022
Sequence:	SKD0114	Injection Date:	04/09/22
Lab Sample ID:	SKD0114-CCV2	Injection Time:	07:22
Sequence Name:	CS3M3		

		CONC. (ng/mL)		RESPONSE FACTOR (RRF)			% DRIFT/DIFF	
COMPOUND	TYPE	STD	CCV	ICAL	CCV	MIN	CCV	LIMIT
2,3,7,8-TCDF	A	10.000	9.46	0.9847005	0.9319797		-5.4	+/-16
2,3,7,8-TCDD	A	10.000	8.95	1.1678960	1.0452330		-10.5	+/-22
1,2,3,7,8-PeCDF	A	50.000	48.3	0.9056077	0.8749294		-3.4	+/-18
2,3,4,7,8-PeCDF	A	50.000	48.1	1.0075470	0.9700348		-3.7	+/-18
1,2,3,7,8-PeCDD	A	50.000	51.0	1.1518210	1.1753500		2.0	+/-22
1,2,3,4,7,8-HxCDF	A	50.000	50.5	1.0453780	1.0549040		0.9	+/-10
1,2,3,6,7,8-HxCDF	A	50.000	51.4	1.0194580	1.0477150		2.8	+/-12
2,3,4,6,7,8-HxCDF	A	50.000	49.0	1.1009420	1.0790690		-2.0	+/-12
1,2,3,7,8,9-HxCDF	A	50.000	48.1	0.9922439	0.9543209		-3.8	+/-10
1,2,3,4,7,8-HxCDD	A	50.000	50.6	0.9339489	0.9455890		1.2	+/-22
1,2,3,6,7,8-HxCDD	A	50.000	52.3	0.9503637	0.9946256		4.7	+/-22
1,2,3,7,8,9-HxCDD	A	50.000	52.3	0.8735404	0.9134388		4.6	+/-18
1,2,3,4,6,7,8-HpCDF	A	50.000	49.6	1.2432150	1.2342050		-0.7	+/-10
1,2,3,4,7,8,9-HpCDF	A	50.000	52.1	1.1920880	1.2425300		4.2	+/-14
1,2,3,4,6,7,8-HpCDD	A	50.000	49.1	1.2681100	1.2443880		-1.9	+/-14
OCDF	A	100.00	95.4	1.3028850	1.2433870		-4.6	+/-37
OCDD	A	100.00	95.5	1.0892710	1.0401180		-4.5	+/-21
13C12-2,3,7,8-TCDF	A	100.00	102	1.7513890	1.7778342		1.5	+/-29
13C12-2,3,7,8-TCDD	A	100.00	111	1.0814050	1.2055098		11.5	+/-18
13C12-1,2,3,7,8-PeCDF	A	100.00	98.1	1.4417600	1.4144070		-1.9	+/-24
13C12-2,3,4,7,8-PeCDF	A	100.00	98.4	1.3657630	1.3435364		-1.6	+/-23
13C12-1,2,3,7,8-PeCDD	A	100.00	100	0.7763790	0.7783543		0.3	+/-38
13C12-1,2,3,4,7,8-HxCDF	A	100.00	99.4	1.0947840	1.0885831		-0.6	+/-24
13C12-1,2,3,6,7,8-HxCDF	A	100.00	101	1.1676720	1.1761629		0.7	+/-30
13C12-2,3,4,6,7,8-HxCDF	A	100.00	101	1.0228740	1.0333502		1.0	+/-27
13C12-1,2,3,7,8,9-HxCDF	A	100.00	109	0.8787479	0.9615819		9.4	+/-26
13C12-1,2,3,4,7,8-HxCDD	A	100.00	97.0	0.9749220	0.9458114		-3.0	+/-15
13C12-1,2,3,6,7,8-HxCDD	A	100.00	98.4	1.0665120	1.0499658		-1.6	+/-15
13C12-1,2,3,4,6,7,8-HpCDF	A	100.00	100	0.9254863	0.9271072		0.2	+/-22
13C12-1,2,3,4,7,8,9-HpCDF	A	100.00	101	0.7148797	0.7205964		0.8	+/-23
13C12-1,2,3,4,6,7,8-HpCDD	A	100.00	102	0.5816149	0.5923495		1.8	+/-18
13C12-OCDD	A	200.00	220	0.5085582	0.5604733		10.2	+/-52
37Cl4-2,3,7,8-TCDD	A	10.000	9.90	1.1201030	1.1089535		-1.0	+/-21

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

CDD/CDF CHROMATOGRAPHIC RESOLUTION SUMMARY

EPA 1613B

Lab Name: Analytical Resources, LLC
SDG: 22C0456
Instrument .ID: AUTOSPEC01
Lab File ID: 22032303
Date Analyzed: 03/23/22
Time Analyzed: 10:49
Lab Sample ID: SKC0306-RES1
Sequence: SKC0306

Percent Valley Determination for Column: RTX-Dioxin2 ID: 0.25 (mm)

1278-TCDD/2378-TCDD: 12.3

3467-TCDF/2378-TCDF: 13.1

Quality Control (QC) Limits: ≤ 25%

Lab Sample ID	Sample Name	Lab File ID	Data Analyzed	Time Analyzed
SKC0306-ICV1	CS3H1	22032302	03/23/2022	09:30
SKC0306-RES1	ISCH1	22032303	03/23/2022	10:49
SKC0306-CAL1	CSLCH	22032304	03/23/2022	11:36
SKC0306-CAL2	CS1CH	22032305	03/23/2022	12:45
SKC0306-CAL3	CS2CH	22032306	03/23/2022	13:37
SKC0306-CAL4	CS3CH	22032307	03/23/2022	14:24
SKC0306-CAL5	CS4CH	22032308	03/23/2022	15:11
SKC0306-CAL6	CS5CH	22032309	03/23/2022	15:59
SKC0306-SCV1	ICVCH	22032310	03/23/2022	16:46
SKC0306-CCV1	CS3H2	22032311	03/23/2022	17:34
SKC0306-RES2	ISCH2	22032312	03/23/2022	18:26

Analytical Resources, LLC
Analytical Chemists and Consultants

CDD/CDF CHROMATOGRAPHIC RESOLUTION SUMMARY

EPA 1613B

Lab Name: Analytical Resources, LLC
SDG: 22C0456
Instrument .ID: AUTOSPEC01
Lab File ID: 22032312
Date Analyzed: 03/23/22
Time Analyzed: 18:26
Lab Sample ID: SKC0306-RES2
Sequence: SKC0306

Percent Valley Determination for Column: RTX-Dioxin2 ID: 0.25 (mm)

1278-TCDD/2378-TCDD: 13.4

3467-TCDF/2378-TCDF: 14.7

Quality Control (QC) Limits: ≤ 25%

Lab Sample ID	Sample Name	Lab File ID	Data Analyzed	Time Analyzed
SKC0306-ICV1	CS3H1	22032302	03/23/2022	09:30
SKC0306-RES1	ISCH1	22032303	03/23/2022	10:49
SKC0306-CAL1	CSLCH	22032304	03/23/2022	11:36
SKC0306-CAL2	CS1CH	22032305	03/23/2022	12:45
SKC0306-CAL3	CS2CH	22032306	03/23/2022	13:37
SKC0306-CAL4	CS3CH	22032307	03/23/2022	14:24
SKC0306-CAL5	CS4CH	22032308	03/23/2022	15:11
SKC0306-CAL6	CS5CH	22032309	03/23/2022	15:59
SKC0306-SCV1	ICVCH	22032310	03/23/2022	16:46
SKC0306-CCV1	CS3H2	22032311	03/23/2022	17:34
SKC0306-RES2	ISCH2	22032312	03/23/2022	18:26

Analytical Resources, LLC
Analytical Chemists and Consultants

CDD/CDF CHROMATOGRAPHIC RESOLUTION SUMMARY

EPA 1613B

Lab Name: Analytical Resources, LLC
SDG: 22C0456
Instrument .ID: AUTOSPEC01
Lab File ID: 22040803
Date Analyzed: 04/08/22
Time Analyzed: 12:53
Lab Sample ID: SKD0114-RES1
Sequence: SKD0114

Percent Valley Determination for Column: RTX-Dioxin2 ID: 0.25 (mm)

1278-TCDD/2378-TCDD: 9.8

3467-TCDF/2378-TCDF: 13.6

Quality Control (QC) Limits: ≤ 25%

Lab Sample ID	Sample Name	Lab File ID	Data Analyzed	Time Analyzed
SKD0114-ICV1	CS3M1	22040802	04/08/2022	11:57
SKD0114-RES1	ISCM1	22040803	04/08/2022	12:53
BKC0836-BLK1	Blank	22040804	04/08/2022	13:40
BKC0836-BS1	LCS	22040805	04/08/2022	14:28
BKC0836-BSD1	LCS Dup	22040806	04/08/2022	15:16
22C0456-01	MW-CP1-032322	22040807	04/08/2022	16:04
22C0456-02	MW-CP1-032322-D	22040808	04/08/2022	16:52
22C0456-03	MW-CP2-032322	22040809	04/08/2022	17:40
22C0456-04	MW-CP3-032322	22040810	04/08/2022	18:28
22C0456-05	MW-CP4-032322	22040811	04/08/2022	19:16
22C0456-06	MW-CP5-032322	22040812	04/08/2022	20:04
22C0456-07	MW-CP6-032322	22040813	04/08/2022	20:52
SKD0114-CCV1	CS3M2	22040814	04/08/2022	21:40
SKD0114-RES2	ISCM2	22040815	04/08/2022	22:32
22C0456-08	MW-CP7-032322	22040816	04/08/2022	23:23
22C0456-09	MW-VB3-032322	22040817	04/09/2022	00:11
22C0456-10	HCOO-B312-032322	22040818	04/09/2022	00:59
22C0456-11	MW-C1-VB1-032422	22040819	04/09/2022	01:47
22C0456-12	MW-C1-VB1-032422-D	22040820	04/09/2022	02:35
22C0456-15	MW-C1-VB2-032422	22040821	04/09/2022	03:23
SKD0114-CCV2	CS3M3	22040826	04/09/2022	07:22
SKD0114-RES3	ISCM3	22040827	04/09/2022	08:15

Analytical Resources, LLC
Analytical Chemists and Consultants

CDD/CDF CHROMATOGRAPHIC RESOLUTION SUMMARY

EPA 1613B

Lab Name: Analytical Resources, LLC
SDG: 22C0456
Instrument .ID: AUTOSPEC01
Lab File ID: 22040815
Date Analyzed: 04/08/22
Time Analyzed: 22:32
Lab Sample ID: SKD0114-RES2
Sequence: SKD0114

Percent Valley Determination for Column: RTX-Dioxin2 ID: 0.25 (mm)

1278-TCDD/2378-TCDD: 9.8

3467-TCDF/2378-TCDF: 15

Quality Control (QC) Limits: ≤ 25%

Lab Sample ID	Sample Name	Lab File ID	Data Analyzed	Time Analyzed
SKD0114-ICV1	CS3M1	22040802	04/08/2022	11:57
SKD0114-RES1	ISCM1	22040803	04/08/2022	12:53
BKC0836-BLK1	Blank	22040804	04/08/2022	13:40
BKC0836-BS1	LCS	22040805	04/08/2022	14:28
BKC0836-BSD1	LCS Dup	22040806	04/08/2022	15:16
22C0456-01	MW-CP1-032322	22040807	04/08/2022	16:04
22C0456-02	MW-CP1-032322-D	22040808	04/08/2022	16:52
22C0456-03	MW-CP2-032322	22040809	04/08/2022	17:40
22C0456-04	MW-CP3-032322	22040810	04/08/2022	18:28
22C0456-05	MW-CP4-032322	22040811	04/08/2022	19:16
22C0456-06	MW-CP5-032322	22040812	04/08/2022	20:04
22C0456-07	MW-CP6-032322	22040813	04/08/2022	20:52
SKD0114-CCV1	CS3M2	22040814	04/08/2022	21:40
SKD0114-RES2	ISCM2	22040815	04/08/2022	22:32
22C0456-08	MW-CP7-032322	22040816	04/08/2022	23:23
22C0456-09	MW-VB3-032322	22040817	04/09/2022	00:11
22C0456-10	HCOO-B312-032322	22040818	04/09/2022	00:59
22C0456-11	MW-C1-VB1-032422	22040819	04/09/2022	01:47
22C0456-12	MW-C1-VB1-032422-D	22040820	04/09/2022	02:35
22C0456-15	MW-C1-VB2-032422	22040821	04/09/2022	03:23
SKD0114-CCV2	CS3M3	22040826	04/09/2022	07:22
SKD0114-RES3	ISCM3	22040827	04/09/2022	08:15

Analytical Resources, LLC
Analytical Chemists and Consultants

CDD/CDF CHROMATOGRAPHIC RESOLUTION SUMMARY

EPA 1613B

Lab Name: Analytical Resources, LLC
SDG: 22C0456
Instrument .ID: AUTOSPEC01
Lab File ID: 22040827
Date Analyzed: 04/09/22
Time Analyzed: 08:15
Lab Sample ID: SKD0114-RES3
Sequence: SKD0114

Percent Valley Determination for Column: RTX-Dioxin2 ID: 0.25 (mm)

1278-TCDD/2378-TCDD: 17.7

3467-TCDF/2378-TCDF: 17.3

Quality Control (QC) Limits: ≤ 25%

Lab Sample ID	Sample Name	Lab File ID	Data Analyzed	Time Analyzed
SKD0114-ICV1	CS3M1	22040802	04/08/2022	11:57
SKD0114-RES1	ISCM1	22040803	04/08/2022	12:53
BKC0836-BLK1	Blank	22040804	04/08/2022	13:40
BKC0836-BS1	LCS	22040805	04/08/2022	14:28
BKC0836-BSD1	LCS Dup	22040806	04/08/2022	15:16
22C0456-01	MW-CP1-032322	22040807	04/08/2022	16:04
22C0456-02	MW-CP1-032322-D	22040808	04/08/2022	16:52
22C0456-03	MW-CP2-032322	22040809	04/08/2022	17:40
22C0456-04	MW-CP3-032322	22040810	04/08/2022	18:28
22C0456-05	MW-CP4-032322	22040811	04/08/2022	19:16
22C0456-06	MW-CP5-032322	22040812	04/08/2022	20:04
22C0456-07	MW-CP6-032322	22040813	04/08/2022	20:52
SKD0114-CCV1	CS3M2	22040814	04/08/2022	21:40
SKD0114-RES2	ISCM2	22040815	04/08/2022	22:32
22C0456-08	MW-CP7-032322	22040816	04/08/2022	23:23
22C0456-09	MW-VB3-032322	22040817	04/09/2022	00:11
22C0456-10	HCOO-B312-032322	22040818	04/09/2022	00:59
22C0456-11	MW-C1-VB1-032422	22040819	04/09/2022	01:47
22C0456-12	MW-C1-VB1-032422-D	22040820	04/09/2022	02:35
22C0456-15	MW-C1-VB2-032422	22040821	04/09/2022	03:23
SKD0114-CCV2	CS3M3	22040826	04/09/2022	07:22
SKD0114-RES3	ISCM3	22040827	04/09/2022	08:15

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKC0306	Instrument:	AUTOSPEC01
		Calibration:	FC00062

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
CS3H1	SKC0306-ICV1	22032302	NA	03/23/22 09:30
ISCH1	SKC0306-RES1	22032303	NA	03/23/22 10:49
CSLCH	SKC0306-CAL1	22032304	NA	03/23/22 11:36
CS1CH	SKC0306-CAL2	22032305	NA	03/23/22 12:45
CS2CH	SKC0306-CAL3	22032306	NA	03/23/22 13:37
CS3CH	SKC0306-CAL4	22032307	NA	03/23/22 14:24
CS4CH	SKC0306-CAL5	22032308	NA	03/23/22 15:11
CS5CH	SKC0306-CAL6	22032309	NA	03/23/22 15:59
ICVCH	SKC0306-SCV1	22032310	NA	03/23/22 16:46
CS3H2	SKC0306-CCV1	22032311	NA	03/23/22 17:34
ISCH2	SKC0306-RES2	22032312	NA	03/23/22 18:26

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 1613B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Sequence: SKD0114
Instrument: AUTOSPEC01
Calibration: FC00062

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
CS3M1	SKD0114-ICV1	22040802	NA	04/08/22 11:57
ISCM1	SKD0114-RES1	22040803	NA	04/08/22 12:53
Blank	BKC0836-BLK1	22040804	Water	04/08/22 13:40
LCS	BKC0836-BS1	22040805	Water	04/08/22 14:28
LCS Dup	BKC0836-BSD1	22040806	Water	04/08/22 15:16
MW-CP1-032322	22C0456-01	22040807	Water	04/08/22 16:04
MW-CP1-032322-D	22C0456-02	22040808	Water	04/08/22 16:52
MW-CP2-032322	22C0456-03	22040809	Water	04/08/22 17:40
MW-CP3-032322	22C0456-04	22040810	Water	04/08/22 18:28
MW-CP4-032322	22C0456-05	22040811	Water	04/08/22 19:16
MW-CP5-032322	22C0456-06	22040812	Water	04/08/22 20:04
MW-CP6-032322	22C0456-07	22040813	Water	04/08/22 20:52
CS3M2	SKD0114-CCV1	22040814	NA	04/08/22 21:40
ISCM2	SKD0114-RES2	22040815	NA	04/08/22 22:32
MW-CP7-032322	22C0456-08	22040816	Water	04/08/22 23:23
MW-VB3-032322	22C0456-09	22040817	Water	04/09/22 00:11
HCOO-B312-032322	22C0456-10	22040818	Water	04/09/22 00:59
MW-C1-VB1-032422	22C0456-11	22040819	Water	04/09/22 01:47
MW-C1-VB1-032422-D	22C0456-12	22040820	Water	04/09/22 02:35
MW-C1-VB2-032422	22C0456-15	22040821	Water	04/09/22 03:23
CS3M3	SKD0114-CCV2	22040826	NA	04/09/22 07:22
ISCM3	SKD0114-RES3	22040827	NA	04/09/22 08:15

Analytical Resources, LLC
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Printed: 4/11/2022 12:27:30PM

ANALYSIS SEQUENCE

SKD0114

Instrument: AUTOSPEC01 Element Column ID: k2341
Calibration ID: FC00062 Tune File: FEB1622-1-5
EM Voltage: 360 Resolution check times : 11:50, 22:32, 08:15

Lab Number	Sample Name	Analysis	Container	Order	STD ID	ISTD ID	Analyzed	File ID	Analyst	Comments
SKD0114-ICV1	CS3M1	QC		1	J001522					
SKD0114-RES1	ISCM1	QC		2	J012679					
BKC0836-BLK1	Blank	QC		3		J011426				
BKC0836-BS1	LCS	QC		4		J011426				
BKC0836-BSD1	LCS Dup	QC		5		J011426				
22C0456-01	MW-CP1-032322	1613B Dioxin	B 01	6		J011426				
22C0456-02	MW-CP1-032322-D	1613B Dioxin	B 01	7		J011426				
22C0456-03	MW-CP2-032322	1613B Dioxin	B 01	8		J011426				
22C0456-04	MW-CP3-032322	1613B Dioxin	B 01	9		J011426				
22C0456-05	MW-CP4-032322	1613B Dioxin	B 01	10		J011426				
22C0456-06	MW-CP5-032322	1613B Dioxin	B 01	11		J011426				
22C0456-07	MW-CP6-032322	1613B Dioxin	B 01	12		J011426				
SKD0114-CCV1	CS3M2	QC		13	J001522					
SKD0114-RES2	ISCM2	QC		14	J012679					
22C0456-08	MW-CP7-032322	1613B Dioxin	B 01	15		J011426				
22C0456-09	MW-VB3-032322	1613B Dioxin	B 01	16		J011426				
22C0456-10	HCOO-B312-032322	1613B Dioxin	B 01	17		J011426				
22C0456-11	MW-C1-VB1-032422	1613B Dioxin	B 01	18		J011426				
22C0456-12	MW-C1-VB1-032422-D	1613B Dioxin	B 01	19		J011426				
22C0456-15	MW-C1-VB2-032422	1613B Dioxin	B 01	20		J011426				
22C0489-01	RP032422-11	1613B Dioxin	A 01	21		J011426				
22C0489-02	RP032422-12	1613B Dioxin	A 01	22		J011426				

ANALYSIS SEQUENCE

SKD0114

Instrument: AUTOSPEC01 Element Column ID: k2341
Calibration ID: FC00062 Tune File: FEB1622-1-5
EM Voltage: 360 Resolution check times : 11:50, 22:32, 08:15

Lab Number	Sample Name	Analysis	Container	Order	STD ID	ISTD ID	Analyzed	File ID	Analyst	Comments
22C0489-03	RP032422-13	1613B Dioxin	A 01	23		J011426				
22C0489-06	RP032422-16	1613B Dioxin	A 01	24		J011426				
SKD0114-CCV2	CS3M3	QC		25	J001522					
SKD0114-RES3	ISCM3	QC		26	J012679					

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKC0306	Instrument:	AUTOSPEC01
Sample ID:	SKC0306-ICV1	Calibration:	FC00062
File ID:	22032302	Analyzed:	03/23/22 09:30

Surrogate Compound	Spike Level ng/mL	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	100.00	95.8	71 - 129	24.792	24.76933	0.0227	N/A	
13C12-2,3,7,8-TCDD	100.00	104	82 - 118	25.4422	25.4145	0.0277	N/A	
13C12-1,2,3,7,8-PeCDF	100.00	96.3	76 - 124	28.9212	28.8992	0.0220	N/A	
13C12-2,3,4,7,8-PeCDF	100.00	95.7	77 - 123	30.2582	30.24362	0.0146	N/A	
13C12-1,2,3,7,8-PeCDD	100.00	100	62 - 138	30.5255	30.5054	0.0201	N/A	
13C12-1,2,3,4,7,8-HxCDF	100.00	93.1	76 - 124	33.9123	33.8999	0.0124	N/A	
13C12-1,2,3,6,7,8-HxCDF	100.00	90.8	70 - 130	34.0572	34.04103	0.0162	N/A	
13C12-2,3,4,6,7,8-HxCDF	100.00	92.7	73 - 127	34.9483	34.93782	0.0105	N/A	
13C12-1,2,3,7,8,9-HxCDF	100.00	101	74 - 126	35.9957	35.97962	0.0161	N/A	
13C12-1,2,3,4,7,8-HxCDD	100.00	96.1	85 - 115	35.082	35.0678	0.0142	N/A	
13C12-1,2,3,6,7,8-HxCDD	100.00	95.7	85 - 115	35.2047	35.18663	0.0181	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	100.00	94.8	78 - 122	37.8787	37.86993	0.0088	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	100.00	96.4	77 - 123	40.0177	40.00348	0.0142	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	100.00	104	72 - 128	39.327	39.31458	0.0124	N/A	
13C12-OCDD	200.00	104	48 - 152	43.7762	43.75875	0.0175	N/A	
37Cl4-2,3,7,8-TCDD	10.000	95.9	0 - 200	25.4572	25.43467	0.0225	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKC0306	Instrument:	AUTOSPEC01
Sample ID:	SKC0306-SCV1	Calibration:	FC00062
File ID:	22032310	Analyzed:	03/23/22 16:46

Surrogate Compound	Spike Level ng/mL	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	100.00	102	0 - 200	24.7617	24.76933	-0.0076	N/A	
13C12-2,3,7,8-TCDD	100.00	82.0	0 - 200	25.3967	25.4145	-0.0178	N/A	
13C12-1,2,3,7,8-PeCDF	100.00	104	0 - 200	28.8878	28.8992	-0.0114	N/A	
13C12-2,3,4,7,8-PeCDF	100.00	107	0 - 200	30.236	30.24362	-0.0076	N/A	
13C12-1,2,3,7,8-PeCDD	100.00	97.8	0 - 200	30.4922	30.5054	-0.0132	N/A	
13C12-1,2,3,4,7,8-HxCDF	100.00	118	0 - 200	33.8903	33.8999	-0.0096	N/A	
13C12-1,2,3,6,7,8-HxCDF	100.00	123	0 - 200	34.0352	34.04103	-0.0058	N/A	
13C12-2,3,4,6,7,8-HxCDF	100.00	112	0 - 200	34.9265	34.93782	-0.0113	N/A	
13C12-1,2,3,7,8,9-HxCDF	100.00	116	0 - 200	35.9737	35.97962	-0.0059	N/A	
13C12-1,2,3,4,7,8-HxCDD	100.00	115	0 - 200	35.0602	35.0678	-0.0076	N/A	
13C12-1,2,3,6,7,8-HxCDD	100.00	119	0 - 200	35.1827	35.18663	-0.0039	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	100.00	121	0 - 200	37.8678	37.86993	-0.0021	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	100.00	111	0 - 200	39.9958	40.00348	-0.0077	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	100.00	111	0 - 200	39.305	39.31458	-0.0096	N/A	
13C12-OCDD	200.00	108	0 - 200	43.7493	43.75875	-0.0095	N/A	
37Cl4-2,3,7,8-TCDD	10.000	105	0 - 200	25.427	25.43467	-0.0077	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKC0306	Instrument:	AUTOSPEC01
Sample ID:	SKC0306-CCV1	Calibration:	FC00062
File ID:	22032311	Analyzed:	03/23/22 17:34

Surrogate Compound	Spike Level ng/mL	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	100.00	101	71 - 129	24.7468	24.76933	-0.0225	N/A	
13C12-2,3,7,8-TCDD	100.00	104	82 - 118	25.397	25.4145	-0.0175	N/A	
13C12-1,2,3,7,8-PeCDF	100.00	100	76 - 124	28.8772	28.8992	-0.0220	N/A	
13C12-2,3,4,7,8-PeCDF	100.00	99.4	77 - 123	30.2253	30.24362	-0.0183	N/A	
13C12-1,2,3,7,8-PeCDD	100.00	96.3	62 - 138	30.4817	30.5054	-0.0237	N/A	
13C12-1,2,3,4,7,8-HxCDF	100.00	106	76 - 124	33.8798	33.8999	-0.0201	N/A	
13C12-1,2,3,6,7,8-HxCDF	100.00	105	70 - 130	34.0247	34.04103	-0.0163	N/A	
13C12-2,3,4,6,7,8-HxCDF	100.00	108	73 - 127	34.916	34.93782	-0.0218	N/A	
13C12-1,2,3,7,8,9-HxCDF	100.00	105	74 - 126	35.9633	35.97962	-0.0163	N/A	
13C12-1,2,3,4,7,8-HxCDD	100.00	99.9	85 - 115	35.0497	35.0678	-0.0181	N/A	
13C12-1,2,3,6,7,8-HxCDD	100.00	103	85 - 115	35.1723	35.18663	-0.0143	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	100.00	108	78 - 122	37.8575	37.86993	-0.0124	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	100.00	104	77 - 123	39.9855	40.00348	-0.0180	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	100.00	104	72 - 128	39.2948	39.31458	-0.0198	N/A	
13C12-OCDD	200.00	106	48 - 152	43.741	43.75875	-0.0177	N/A	
37Cl4-2,3,7,8-TCDD	10.000	96.1	0 - 200	25.4122	25.43467	-0.0225	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	SKD0114-ICV1	Calibration:	FC00062
File ID:	22040802	Analyzed:	04/08/22 11:57

Surrogate Compound	Spike Level ng/mL	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	100.00	104	71 - 129	24.535	24.76933	-0.2343	N/A	
13C12-2,3,7,8-TCDD	100.00	111	82 - 118	25.17	25.4145	-0.2445	N/A	
13C12-1,2,3,7,8-PeCDF	100.00	101	76 - 124	28.6523	28.8992	-0.2469	N/A	
13C12-2,3,4,7,8-PeCDF	100.00	99.7	77 - 123	29.9893	30.24362	-0.2543	N/A	
13C12-1,2,3,7,8-PeCDD	100.00	105	62 - 138	30.2457	30.5054	-0.2597	N/A	
13C12-1,2,3,4,7,8-HxCDF	100.00	94.6	76 - 124	33.6437	33.8999	-0.2562	N/A	
13C12-1,2,3,6,7,8-HxCDF	100.00	94.7	70 - 130	33.7885	34.04103	-0.2525	N/A	
13C12-2,3,4,6,7,8-HxCDF	100.00	96.7	73 - 127	34.6908	34.93782	-0.2470	N/A	
13C12-1,2,3,7,8,9-HxCDF	100.00	103	74 - 126	35.7382	35.97962	-0.2414	N/A	
13C12-1,2,3,4,7,8-HxCDD	100.00	97.0	85 - 115	34.8245	35.0678	-0.2433	N/A	
13C12-1,2,3,6,7,8-HxCDD	100.00	94.2	85 - 115	34.936	35.18663	-0.2506	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	100.00	92.4	78 - 122	37.6322	37.86993	-0.2377	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	100.00	96.2	77 - 123	39.749	40.00348	-0.2545	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	100.00	101	82 - 118	39.0693	39.31458	-0.2453	N/A	
13C12-OCDD	200.00	110	48 - 152	43.4383	43.75875	-0.3205	N/A	
37Cl4-2,3,7,8-TCDD	10.000	103	79 - 121	25.2003	25.43467	-0.2344	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	BKC0836-BLK1	Calibration:	FC00062
File ID:	22040804	Analyzed:	04/08/22 13:40

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	2000.0	96.2	24 - 169	24.5198	24.76933	-0.2495	N/A	
13C12-2,3,7,8-TCDD	2000.0	108	25 - 164	25.1548	25.4145	-0.2597	N/A	
13C12-1,2,3,7,8-PeCDF	2000.0	96.9	24 - 185	28.6413	28.8992	-0.2579	N/A	
13C12-2,3,4,7,8-PeCDF	2000.0	97.9	21 - 178	29.9782	30.24362	-0.2654	N/A	
13C12-1,2,3,7,8-PeCDD	2000.0	101	25 - 181	30.2345	30.5054	-0.2709	N/A	
13C12-1,2,3,4,7,8-HxCDF	2000.0	96.6	26 - 152	33.6325	33.8999	-0.2674	N/A	
13C12-1,2,3,6,7,8-HxCDF	2000.0	97.3	26 - 123	33.7773	34.04103	-0.2637	N/A	
13C12-2,3,4,6,7,8-HxCDF	2000.0	96.4	28 - 136	34.6798	34.93782	-0.2580	N/A	
13C12-1,2,3,7,8,9-HxCDF	2000.0	103	29 - 147	35.727	35.97962	-0.2526	N/A	
13C12-1,2,3,4,7,8-HxCDD	2000.0	96.6	32 - 141	34.8137	35.0678	-0.2541	N/A	
13C12-1,2,3,6,7,8-HxCDD	2000.0	97.4	28 - 130	34.9362	35.18663	-0.2504	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	2000.0	93.9	28 - 143	37.6323	37.86993	-0.2376	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	2000.0	98.5	26 - 138	39.749	40.00348	-0.2545	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	2000.0	101	23 - 140	39.0695	39.31458	-0.2451	N/A	
13C12-OCDD	4000.0	106	17 - 157	43.4293	43.75875	-0.3295	N/A	
37Cl4-2,3,7,8-TCDD	800.00	107	35 - 197	25.17	25.43467	-0.2647	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	BKC0836-BS1	Calibration:	FC00062
File ID:	22040805	Analyzed:	04/08/22 14:28

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	2000.0	93.5	24 - 169	24.5047	24.76933	-0.2646	N/A	
13C12-2,3,7,8-TCDD	2000.0	106	25 - 164	25.1548	25.4145	-0.2597	N/A	
13C12-1,2,3,7,8-PeCDF	2000.0	98.0	24 - 185	28.63	28.8992	-0.2692	N/A	
13C12-2,3,4,7,8-PeCDF	2000.0	97.5	21 - 178	29.9668	30.24362	-0.2768	N/A	
13C12-1,2,3,7,8-PeCDD	2000.0	101	25 - 181	30.2343	30.5054	-0.2711	N/A	
13C12-1,2,3,4,7,8-HxCDF	2000.0	94.1	26 - 152	33.6212	33.8999	-0.2787	N/A	
13C12-1,2,3,6,7,8-HxCDF	2000.0	93.3	26 - 123	33.766	34.04103	-0.2750	N/A	
13C12-2,3,4,6,7,8-HxCDF	2000.0	93.5	28 - 136	34.6685	34.93782	-0.2693	N/A	
13C12-1,2,3,7,8,9-HxCDF	2000.0	101	29 - 147	35.7157	35.97962	-0.2639	N/A	
13C12-1,2,3,4,7,8-HxCDD	2000.0	98.7	32 - 141	34.8022	35.0678	-0.2656	N/A	
13C12-1,2,3,6,7,8-HxCDD	2000.0	97.5	28 - 130	34.9247	35.18663	-0.2619	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	2000.0	92.9	28 - 143	37.6208	37.86993	-0.2491	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	2000.0	100	26 - 138	39.7377	40.00348	-0.2658	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	2000.0	101	23 - 140	39.0582	39.31458	-0.2564	N/A	
13C12-OCDD	4000.0	108	17 - 157	43.4198	43.75875	-0.3389	N/A	
37Cl4-2,3,7,8-TCDD	800.00	100	35 - 197	25.17	25.43467	-0.2647	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	BKC0836-BSD1	Calibration:	FC00062
File ID:	22040806	Analyzed:	04/08/22 15:16

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	2000.0	96.7	24 - 169	24.5198	24.76933	-0.2495	N/A	
13C12-2,3,7,8-TCDD	2000.0	108	25 - 164	25.1548	25.4145	-0.2597	N/A	
13C12-1,2,3,7,8-PeCDF	2000.0	96.2	24 - 185	28.63	28.8992	-0.2692	N/A	
13C12-2,3,4,7,8-PeCDF	2000.0	96.8	21 - 178	29.978	30.24362	-0.2656	N/A	
13C12-1,2,3,7,8-PeCDD	2000.0	98.6	25 - 181	30.2343	30.5054	-0.2711	N/A	
13C12-1,2,3,4,7,8-HxCDF	2000.0	94.7	26 - 152	33.6323	33.8999	-0.2676	N/A	
13C12-1,2,3,6,7,8-HxCDF	2000.0	94.5	26 - 123	33.7772	34.04103	-0.2638	N/A	
13C12-2,3,4,6,7,8-HxCDF	2000.0	93.8	28 - 136	34.6797	34.93782	-0.2581	N/A	
13C12-1,2,3,7,8,9-HxCDF	2000.0	99.6	29 - 147	35.727	35.97962	-0.2526	N/A	
13C12-1,2,3,4,7,8-HxCDD	2000.0	96.9	32 - 141	34.8133	35.0678	-0.2545	N/A	
13C12-1,2,3,6,7,8-HxCDD	2000.0	96.7	28 - 130	34.9248	35.18663	-0.2618	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	2000.0	94.3	28 - 143	37.621	37.86993	-0.2489	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	2000.0	91.8	26 - 138	39.7377	40.00348	-0.2658	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	2000.0	101	23 - 140	39.0693	39.31458	-0.2453	N/A	
13C12-OCDD	4000.0	103	17 - 157	43.429	43.75875	-0.3297	N/A	
37Cl4-2,3,7,8-TCDD	800.00	103	35 - 197	25.17	25.43467	-0.2647	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-01	Calibration:	FC00062
File ID:	22040807	Analyzed:	04/08/22 16:04

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	1886.8	94.7	24 - 169	24.5048	24.76933	-0.2645	N/A	
13C12-2,3,7,8-TCDD	1886.8	108	25 - 164	25.1398	25.4145	-0.2747	N/A	
13C12-1,2,3,7,8-PeCDF	1886.8	96.5	24 - 185	28.619	28.8992	-0.2802	N/A	
13C12-2,3,4,7,8-PeCDF	1886.8	97.7	21 - 178	29.9672	30.24362	-0.2764	N/A	
13C12-1,2,3,7,8-PeCDD	1886.8	99.7	25 - 181	30.2233	30.5054	-0.2821	N/A	
13C12-1,2,3,4,7,8-HxCDF	1886.8	96.1	26 - 152	33.6215	33.8999	-0.2784	N/A	
13C12-1,2,3,6,7,8-HxCDF	1886.8	97.7	26 - 123	33.7663	34.04103	-0.2747	N/A	
13C12-2,3,4,6,7,8-HxCDF	1886.8	97.6	28 - 136	34.6688	34.93782	-0.2690	N/A	
13C12-1,2,3,7,8,9-HxCDF	1886.8	104	29 - 147	35.716	35.97962	-0.2636	N/A	
13C12-1,2,3,4,7,8-HxCDD	1886.8	97.4	32 - 141	34.8025	35.0678	-0.2653	N/A	
13C12-1,2,3,6,7,8-HxCDD	1886.8	97.9	28 - 130	34.9138	35.18663	-0.2728	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	1886.8	93.1	28 - 143	37.6102	37.86993	-0.2597	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	1886.8	93.0	26 - 138	39.727	40.00348	-0.2765	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	1886.8	99.5	23 - 140	39.0473	39.31458	-0.2673	N/A	
13C12-OCDD	3773.6	104	17 - 157	43.4202	43.75875	-0.3385	N/A	
37Cl4-2,3,7,8-TCDD	754.72	104	35 - 197	25.1548	25.43467	-0.2799	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-02	Calibration:	FC00062
File ID:	22040808	Analyzed:	04/08/22 16:52

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	1923.1	95.7	24 - 169	24.5047	24.76933	-0.2646	N/A	
13C12-2,3,7,8-TCDD	1923.1	109	25 - 164	25.1397	25.4145	-0.2748	N/A	
13C12-1,2,3,7,8-PeCDF	1923.1	96.9	24 - 185	28.6188	28.8992	-0.2804	N/A	
13C12-2,3,4,7,8-PeCDF	1923.1	97.2	21 - 178	29.9668	30.24362	-0.2768	N/A	
13C12-1,2,3,7,8-PeCDD	1923.1	98.9	25 - 181	30.2232	30.5054	-0.2822	N/A	
13C12-1,2,3,4,7,8-HxCDF	1923.1	95.4	26 - 152	33.6212	33.8999	-0.2787	N/A	
13C12-1,2,3,6,7,8-HxCDF	1923.1	94.2	26 - 123	33.766	34.04103	-0.2750	N/A	
13C12-2,3,4,6,7,8-HxCDF	1923.1	98.0	28 - 136	34.6683	34.93782	-0.2695	N/A	
13C12-1,2,3,7,8,9-HxCDF	1923.1	101	29 - 147	35.7155	35.97962	-0.2641	N/A	
13C12-1,2,3,4,7,8-HxCDD	1923.1	94.6	32 - 141	34.802	35.0678	-0.2658	N/A	
13C12-1,2,3,6,7,8-HxCDD	1923.1	95.3	28 - 130	34.9247	35.18663	-0.2619	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	1923.1	92.2	28 - 143	37.6207	37.86993	-0.2492	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	1923.1	97.9	26 - 138	39.7375	40.00348	-0.2660	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	1923.1	101	23 - 140	39.058	39.31458	-0.2566	N/A	
13C12-OCDD	3846.2	111	17 - 157	43.4197	43.75875	-0.3391	N/A	
37Cl4-2,3,7,8-TCDD	1538.5	106	35 - 197	25.17	25.43467	-0.2647	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-03	Calibration:	FC00062
File ID:	22040809	Analyzed:	04/08/22 17:40

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	1886.8	101	24 - 169	24.5197	24.76933	-0.2496	N/A	
13C12-2,3,7,8-TCDD	1886.8	107	25 - 164	25.1547	25.4145	-0.2598	N/A	
13C12-1,2,3,7,8-PeCDF	1886.8	104	24 - 185	28.6297	28.8992	-0.2695	N/A	
13C12-2,3,4,7,8-PeCDF	1886.8	104	21 - 178	29.9777	30.24362	-0.2659	N/A	
13C12-1,2,3,7,8-PeCDD	1886.8	99.2	25 - 181	30.234	30.5054	-0.2714	N/A	
13C12-1,2,3,4,7,8-HxCDF	1886.8	101	26 - 152	33.6317	33.8999	-0.2682	N/A	
13C12-1,2,3,6,7,8-HxCDF	1886.8	100	26 - 123	33.7765	34.04103	-0.2645	N/A	
13C12-2,3,4,6,7,8-HxCDF	1886.8	101	28 - 136	34.679	34.93782	-0.2588	N/A	
13C12-1,2,3,7,8,9-HxCDF	1886.8	109	29 - 147	35.7262	35.97962	-0.2534	N/A	
13C12-1,2,3,4,7,8-HxCDD	1886.8	95.7	32 - 141	34.8127	35.0678	-0.2551	N/A	
13C12-1,2,3,6,7,8-HxCDD	1886.8	96.1	28 - 130	34.9242	35.18663	-0.2624	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	1886.8	113	28 - 143	37.6313	37.86993	-0.2386	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	1886.8	115	26 - 138	39.7368	40.00348	-0.2667	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	1886.8	116	23 - 140	39.0685	39.31458	-0.2461	N/A	
13C12-OCDD	3773.6	124	17 - 157	43.4283	43.75875	-0.3304	N/A	
37Cl4-2,3,7,8-TCDD	754.72	105	35 - 197	25.1698	25.43467	-0.2649	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-04	Calibration:	FC00062
File ID:	22040810	Analyzed:	04/08/22 18:28

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	2061.9	90.8	24 - 169	24.5198	24.76933	-0.2495	N/A	
13C12-2,3,7,8-TCDD	2061.9	103	25 - 164	25.1548	25.4145	-0.2597	N/A	
13C12-1,2,3,7,8-PeCDF	2061.9	93.4	24 - 185	28.63	28.8992	-0.2692	N/A	
13C12-2,3,4,7,8-PeCDF	2061.9	90.1	21 - 178	29.978	30.24362	-0.2656	N/A	
13C12-1,2,3,7,8-PeCDD	2061.9	91.4	25 - 181	30.2343	30.5054	-0.2711	N/A	
13C12-1,2,3,4,7,8-HxCDF	2061.9	91.9	26 - 152	33.6323	33.8999	-0.2676	N/A	
13C12-1,2,3,6,7,8-HxCDF	2061.9	93.9	26 - 123	33.7772	34.04103	-0.2638	N/A	
13C12-2,3,4,6,7,8-HxCDF	2061.9	91.8	28 - 136	34.6798	34.93782	-0.2580	N/A	
13C12-1,2,3,7,8,9-HxCDF	2061.9	94.9	29 - 147	35.7268	35.97962	-0.2528	N/A	
13C12-1,2,3,4,7,8-HxCDD	2061.9	92.0	32 - 141	34.8135	35.0678	-0.2543	N/A	
13C12-1,2,3,6,7,8-HxCDD	2061.9	93.6	28 - 130	34.9248	35.18663	-0.2618	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	2061.9	86.9	28 - 143	37.632	37.86993	-0.2379	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	2061.9	89.6	26 - 138	39.7377	40.00348	-0.2658	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	2061.9	95.6	23 - 140	39.0583	39.31458	-0.2563	N/A	
13C12-OCDD	4123.7	94.5	17 - 157	43.429	43.75875	-0.3297	N/A	
37Cl4-2,3,7,8-TCDD	824.74	99.2	35 - 197	25.17	25.43467	-0.2647	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-05	Calibration:	FC00062
File ID:	22040811	Analyzed:	04/08/22 19:16

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	1895.7	89.3	24 - 169	24.5045	24.76933	-0.2648	N/A	
13C12-2,3,7,8-TCDD	1895.7	101	25 - 164	25.1395	25.4145	-0.2750	N/A	
13C12-1,2,3,7,8-PeCDF	1895.7	91.1	24 - 185	28.6187	28.8992	-0.2805	N/A	
13C12-2,3,4,7,8-PeCDF	1895.7	90.6	21 - 178	29.9667	30.24362	-0.2769	N/A	
13C12-1,2,3,7,8-PeCDD	1895.7	93.5	25 - 181	30.223	30.5054	-0.2824	N/A	
13C12-1,2,3,4,7,8-HxCDF	1895.7	91.4	26 - 152	33.6208	33.8999	-0.2791	N/A	
13C12-1,2,3,6,7,8-HxCDF	1895.7	90.1	26 - 123	33.7657	34.04103	-0.2753	N/A	
13C12-2,3,4,6,7,8-HxCDF	1895.7	92.0	28 - 136	34.6682	34.93782	-0.2696	N/A	
13C12-1,2,3,7,8,9-HxCDF	1895.7	94.1	29 - 147	35.7153	35.97962	-0.2643	N/A	
13C12-1,2,3,4,7,8-HxCDD	1895.7	88.9	32 - 141	34.8018	35.0678	-0.2660	N/A	
13C12-1,2,3,6,7,8-HxCDD	1895.7	90.0	28 - 130	34.9245	35.18663	-0.2621	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	1895.7	87.8	28 - 143	37.6205	37.86993	-0.2494	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	1895.7	88.9	26 - 138	39.7262	40.00348	-0.2773	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	1895.7	89.7	23 - 140	39.0577	39.31458	-0.2569	N/A	
13C12-OCDD	3791.5	97.1	17 - 157	43.4193	43.75875	-0.3394	N/A	
37Cl4-2,3,7,8-TCDD	758.29	96.7	35 - 197	25.1698	25.43467	-0.2649	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-06	Calibration:	FC00062
File ID:	22040812	Analyzed:	04/08/22 20:04

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	1964.6	88.3	24 - 169	24.5047	24.76933	-0.2646	N/A	
13C12-2,3,7,8-TCDD	1964.6	99.3	25 - 164	25.1548	25.4145	-0.2597	N/A	
13C12-1,2,3,7,8-PeCDF	1964.6	92.4	24 - 185	28.6302	28.8992	-0.2690	N/A	
13C12-2,3,4,7,8-PeCDF	1964.6	90.8	21 - 178	29.9782	30.24362	-0.2654	N/A	
13C12-1,2,3,7,8-PeCDD	1964.6	94.2	25 - 181	30.2345	30.5054	-0.2709	N/A	
13C12-1,2,3,4,7,8-HxCDF	1964.6	89.4	26 - 152	33.6213	33.8999	-0.2786	N/A	
13C12-1,2,3,6,7,8-HxCDF	1964.6	89.7	26 - 123	33.7662	34.04103	-0.2748	N/A	
13C12-2,3,4,6,7,8-HxCDF	1964.6	92.0	28 - 136	34.6687	34.93782	-0.2691	N/A	
13C12-1,2,3,7,8,9-HxCDF	1964.6	98.0	29 - 147	35.727	35.97962	-0.2526	N/A	
13C12-1,2,3,4,7,8-HxCDD	1964.6	92.0	32 - 141	34.8023	35.0678	-0.2655	N/A	
13C12-1,2,3,6,7,8-HxCDD	1964.6	89.5	28 - 130	34.9248	35.18663	-0.2618	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	1964.6	88.4	28 - 143	37.6208	37.86993	-0.2491	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	1964.6	94.8	26 - 138	39.7378	40.00348	-0.2657	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	1964.6	94.3	23 - 140	39.0582	39.31458	-0.2564	N/A	
13C12-OCDD	3929.3	99.2	17 - 157	43.42	43.75875	-0.3387	N/A	
37Cl4-2,3,7,8-TCDD	785.85	95.4	35 - 197	25.17	25.43467	-0.2647	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-07	Calibration:	FC00062
File ID:	22040813	Analyzed:	04/08/22 20:52

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	1947.4	94.6	24 - 169	24.4897	24.76933	-0.2796	N/A	
13C12-2,3,7,8-TCDD	1947.4	107	25 - 164	25.1397	25.4145	-0.2748	N/A	
13C12-1,2,3,7,8-PeCDF	1947.4	94.2	24 - 185	28.6187	28.8992	-0.2805	N/A	
13C12-2,3,4,7,8-PeCDF	1947.4	94.7	21 - 178	29.9557	30.24362	-0.2879	N/A	
13C12-1,2,3,7,8-PeCDD	1947.4	97.4	25 - 181	30.2118	30.5054	-0.2936	N/A	
13C12-1,2,3,4,7,8-HxCDF	1947.4	93.6	26 - 152	33.61	33.8999	-0.2899	N/A	
13C12-1,2,3,6,7,8-HxCDF	1947.4	92.9	26 - 123	33.7548	34.04103	-0.2862	N/A	
13C12-2,3,4,6,7,8-HxCDF	1947.4	93.2	28 - 136	34.6573	34.93782	-0.2805	N/A	
13C12-1,2,3,7,8,9-HxCDF	1947.4	96.8	29 - 147	35.7045	35.97962	-0.2751	N/A	
13C12-1,2,3,4,7,8-HxCDD	1947.4	93.9	32 - 141	34.791	35.0678	-0.2768	N/A	
13C12-1,2,3,6,7,8-HxCDD	1947.4	90.1	28 - 130	34.9135	35.18663	-0.2731	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	1947.4	88.6	28 - 143	37.6095	37.86993	-0.2604	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	1947.4	92.3	26 - 138	39.7263	40.00348	-0.2772	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	1947.4	96.4	23 - 140	39.0468	39.31458	-0.2678	N/A	
13C12-OCDD	3894.8	96.1	17 - 157	43.4105	43.75875	-0.3483	N/A	
37Cl4-2,3,7,8-TCDD	778.97	103	35 - 197	25.1548	25.43467	-0.2799	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	SKD0114-CCV1	Calibration:	FC00062
File ID:	22040814	Analyzed:	04/08/22 21:40

Surrogate Compound	Spike Level ng/mL	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	100.00	104	71 - 129	24.5047	24.76933	-0.2646	N/A	
13C12-2,3,7,8-TCDD	100.00	114	82 - 118	25.1397	25.4145	-0.2748	N/A	
13C12-1,2,3,7,8-PeCDF	100.00	103	76 - 124	28.6188	28.8992	-0.2804	N/A	
13C12-2,3,4,7,8-PeCDF	100.00	99.9	77 - 123	29.9557	30.24362	-0.2879	N/A	
13C12-1,2,3,7,8-PeCDD	100.00	103	62 - 138	30.2232	30.5054	-0.2822	N/A	
13C12-1,2,3,4,7,8-HxCDF	100.00	98.3	76 - 124	33.61	33.8999	-0.2899	N/A	
13C12-1,2,3,6,7,8-HxCDF	100.00	99.1	70 - 130	33.7548	34.04103	-0.2862	N/A	
13C12-2,3,4,6,7,8-HxCDF	100.00	97.6	73 - 127	34.6573	34.93782	-0.2805	N/A	
13C12-1,2,3,7,8,9-HxCDF	100.00	105	74 - 126	35.7157	35.97962	-0.2639	N/A	
13C12-1,2,3,4,7,8-HxCDD	100.00	99.5	85 - 115	34.791	35.0678	-0.2768	N/A	
13C12-1,2,3,6,7,8-HxCDD	100.00	98.1	85 - 115	34.9135	35.18663	-0.2731	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	100.00	95.4	78 - 122	37.6098	37.86993	-0.2601	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	100.00	101	77 - 123	39.7265	40.00348	-0.2770	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	100.00	101	82 - 118	39.047	39.31458	-0.2676	N/A	
13C12-OCDD	200.00	109	48 - 152	43.4107	43.75875	-0.3481	N/A	
37Cl4-2,3,7,8-TCDD	10.000	105	79 - 121	25.1548	25.43467	-0.2799	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-08	Calibration:	FC00062
File ID:	22040816	Analyzed:	04/08/22 23:23

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	1899.3	94.2	24 - 169	24.4895	24.76933	-0.2798	N/A	
13C12-2,3,7,8-TCDD	1899.3	105	25 - 164	25.1245	25.4145	-0.2900	N/A	
13C12-1,2,3,7,8-PeCDF	1899.3	94.5	24 - 185	28.6077	28.8992	-0.2915	N/A	
13C12-2,3,4,7,8-PeCDF	1899.3	95.4	21 - 178	29.9557	30.24362	-0.2879	N/A	
13C12-1,2,3,7,8-PeCDD	1899.3	96.1	25 - 181	30.212	30.5054	-0.2934	N/A	
13C12-1,2,3,4,7,8-HxCDF	1899.3	94.1	26 - 152	33.61	33.8999	-0.2899	N/A	
13C12-1,2,3,6,7,8-HxCDF	1899.3	95.9	26 - 123	33.7548	34.04103	-0.2862	N/A	
13C12-2,3,4,6,7,8-HxCDF	1899.3	94.4	28 - 136	34.6573	34.93782	-0.2805	N/A	
13C12-1,2,3,7,8,9-HxCDF	1899.3	101	29 - 147	35.7045	35.97962	-0.2751	N/A	
13C12-1,2,3,4,7,8-HxCDD	1899.3	94.4	32 - 141	34.791	35.0678	-0.2768	N/A	
13C12-1,2,3,6,7,8-HxCDD	1899.3	99.2	28 - 130	34.9023	35.18663	-0.2843	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	1899.3	96.9	28 - 143	37.5985	37.86993	-0.2714	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	1899.3	94.4	26 - 138	39.7153	40.00348	-0.2882	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	1899.3	98.3	23 - 140	39.0358	39.31458	-0.2788	N/A	
13C12-OCDD	3798.7	99.9	17 - 157	43.4015	43.75875	-0.3573	N/A	
37Cl4-2,3,7,8-TCDD	759.73	99.9	35 - 197	25.1548	25.43467	-0.2799	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-09	Calibration:	FC00062
File ID:	22040817	Analyzed:	04/09/22 00:11

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	1941.7	76.5	24 - 169	24.5045	24.76933	-0.2648	N/A	
13C12-2,3,7,8-TCDD	1941.7	85.5	25 - 164	25.1397	25.4145	-0.2748	N/A	
13C12-1,2,3,7,8-PeCDF	1941.7	76.3	24 - 185	28.6188	28.8992	-0.2804	N/A	
13C12-2,3,4,7,8-PeCDF	1941.7	76.2	21 - 178	29.9668	30.24362	-0.2768	N/A	
13C12-1,2,3,7,8-PeCDD	1941.7	76.1	25 - 181	30.2232	30.5054	-0.2822	N/A	
13C12-1,2,3,4,7,8-HxCDF	1941.7	77.8	26 - 152	33.6212	33.8999	-0.2787	N/A	
13C12-1,2,3,6,7,8-HxCDF	1941.7	79.6	26 - 123	33.7548	34.04103	-0.2862	N/A	
13C12-2,3,4,6,7,8-HxCDF	1941.7	80.5	28 - 136	34.6685	34.93782	-0.2693	N/A	
13C12-1,2,3,7,8,9-HxCDF	1941.7	82.4	29 - 147	35.7157	35.97962	-0.2639	N/A	
13C12-1,2,3,4,7,8-HxCDD	1941.7	78.0	32 - 141	34.8022	35.0678	-0.2656	N/A	
13C12-1,2,3,6,7,8-HxCDD	1941.7	80.3	28 - 130	34.9137	35.18663	-0.2729	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	1941.7	75.4	28 - 143	37.6097	37.86993	-0.2602	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	1941.7	76.3	26 - 138	39.7265	40.00348	-0.2770	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	1941.7	76.4	23 - 140	39.047	39.31458	-0.2676	N/A	
13C12-OCDD	3883.5	73.0	17 - 157	43.4107	43.75875	-0.3481	N/A	
37Cl4-2,3,7,8-TCDD	776.70	82.8	35 - 197	25.1547	25.43467	-0.2800	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-10	Calibration:	FC00062
File ID:	22040818	Analyzed:	04/09/22 00:59

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	1966.6	97.9	24 - 169	24.4895	24.76933	-0.2798	N/A	
13C12-2,3,7,8-TCDD	1966.6	111	25 - 164	25.1245	25.4145	-0.2900	N/A	
13C12-1,2,3,7,8-PeCDF	1966.6	100	24 - 185	28.6078	28.8992	-0.2914	N/A	
13C12-2,3,4,7,8-PeCDF	1966.6	98.5	21 - 178	29.9558	30.24362	-0.2878	N/A	
13C12-1,2,3,7,8-PeCDD	1966.6	101	25 - 181	30.212	30.5054	-0.2934	N/A	
13C12-1,2,3,4,7,8-HxCDF	1966.6	101	26 - 152	33.61	33.8999	-0.2899	N/A	
13C12-1,2,3,6,7,8-HxCDF	1966.6	104	26 - 123	33.755	34.04103	-0.2860	N/A	
13C12-2,3,4,6,7,8-HxCDF	1966.6	102	28 - 136	34.6575	34.93782	-0.2803	N/A	
13C12-1,2,3,7,8,9-HxCDF	1966.6	108	29 - 147	35.7047	35.97962	-0.2749	N/A	
13C12-1,2,3,4,7,8-HxCDD	1966.6	102	32 - 141	34.7912	35.0678	-0.2766	N/A	
13C12-1,2,3,6,7,8-HxCDD	1966.6	104	28 - 130	34.9027	35.18663	-0.2839	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	1966.6	100	28 - 143	37.6098	37.86993	-0.2601	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	1966.6	103	26 - 138	39.7155	40.00348	-0.2880	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	1966.6	106	23 - 140	39.0472	39.31458	-0.2674	N/A	
13C12-OCDD	3933.1	113	17 - 157	43.4017	43.75875	-0.3571	N/A	
37Cl4-2,3,7,8-TCDD	786.63	106	35 - 197	25.1548	25.43467	-0.2799	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-11	Calibration:	FC00062
File ID:	22040819	Analyzed:	04/09/22 01:47

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	2000.0	97.6	24 - 169	24.5047	24.76933	-0.2646	N/A	
13C12-2,3,7,8-TCDD	2000.0	108	25 - 164	25.1397	25.4145	-0.2748	N/A	
13C12-1,2,3,7,8-PeCDF	2000.0	99.1	24 - 185	28.6188	28.8992	-0.2804	N/A	
13C12-2,3,4,7,8-PeCDF	2000.0	98.1	21 - 178	29.9557	30.24362	-0.2879	N/A	
13C12-1,2,3,7,8-PeCDD	2000.0	98.6	25 - 181	30.212	30.5054	-0.2934	N/A	
13C12-1,2,3,4,7,8-HxCDF	2000.0	98.4	26 - 152	33.61	33.8999	-0.2899	N/A	
13C12-1,2,3,6,7,8-HxCDF	2000.0	97.8	26 - 123	33.7548	34.04103	-0.2862	N/A	
13C12-2,3,4,6,7,8-HxCDF	2000.0	97.8	28 - 136	34.6573	34.93782	-0.2805	N/A	
13C12-1,2,3,7,8,9-HxCDF	2000.0	102	29 - 147	35.7155	35.97962	-0.2641	N/A	
13C12-1,2,3,4,7,8-HxCDD	2000.0	98.6	32 - 141	34.791	35.0678	-0.2768	N/A	
13C12-1,2,3,6,7,8-HxCDD	2000.0	97.6	28 - 130	34.9137	35.18663	-0.2729	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	2000.0	97.4	28 - 143	37.6097	37.86993	-0.2602	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	2000.0	99.6	26 - 138	39.7265	40.00348	-0.2770	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	2000.0	101	23 - 140	39.047	39.31458	-0.2676	N/A	
13C12-OCDD	4000.0	104	17 - 157	43.4107	43.75875	-0.3481	N/A	
37Cl4-2,3,7,8-TCDD	800.00	105	35 - 197	25.1548	25.43467	-0.2799	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-12	Calibration:	FC00062
File ID:	22040820	Analyzed:	04/09/22 02:35

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	2000.0	93.7	24 - 169	24.4895	24.76933	-0.2798	N/A	
13C12-2,3,7,8-TCDD	2000.0	105	25 - 164	25.1395	25.4145	-0.2750	N/A	
13C12-1,2,3,7,8-PeCDF	2000.0	91.4	24 - 185	28.6077	28.8992	-0.2915	N/A	
13C12-2,3,4,7,8-PeCDF	2000.0	95.4	21 - 178	29.9557	30.24362	-0.2879	N/A	
13C12-1,2,3,7,8-PeCDD	2000.0	93.3	25 - 181	30.212	30.5054	-0.2934	N/A	
13C12-1,2,3,4,7,8-HxCDF	2000.0	98.0	26 - 152	33.6098	33.8999	-0.2901	N/A	
13C12-1,2,3,6,7,8-HxCDF	2000.0	98.5	26 - 123	33.7548	34.04103	-0.2862	N/A	
13C12-2,3,4,6,7,8-HxCDF	2000.0	96.9	28 - 136	34.6573	34.93782	-0.2805	N/A	
13C12-1,2,3,7,8,9-HxCDF	2000.0	99.5	29 - 147	35.7045	35.97962	-0.2751	N/A	
13C12-1,2,3,4,7,8-HxCDD	2000.0	96.4	32 - 141	34.791	35.0678	-0.2768	N/A	
13C12-1,2,3,6,7,8-HxCDD	2000.0	101	28 - 130	34.9135	35.18663	-0.2731	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	2000.0	90.1	28 - 143	37.6097	37.86993	-0.2602	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	2000.0	94.4	26 - 138	39.7263	40.00348	-0.2772	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	2000.0	96.2	23 - 140	39.0468	39.31458	-0.2678	N/A	
13C12-OCDD	4000.0	99.5	17 - 157	43.4013	43.75875	-0.3575	N/A	
37Cl4-2,3,7,8-TCDD	800.00	103	35 - 197	25.1547	25.43467	-0.2800	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	22C0456-15	Calibration:	FC00062
File ID:	22040821	Analyzed:	04/09/22 03:23

Surrogate Compound	Spike Level pg/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	1886.8	80.7	24 - 169	24.4895	24.76933	-0.2798	N/A	
13C12-2,3,7,8-TCDD	1886.8	92.0	25 - 164	25.1247	25.4145	-0.2898	N/A	
13C12-1,2,3,7,8-PeCDF	1886.8	84.1	24 - 185	28.6078	28.8992	-0.2914	N/A	
13C12-2,3,4,7,8-PeCDF	1886.8	82.6	21 - 178	29.9445	30.24362	-0.2991	N/A	
13C12-1,2,3,7,8-PeCDD	1886.8	84.8	25 - 181	30.212	30.5054	-0.2934	N/A	
13C12-1,2,3,4,7,8-HxCDF	1886.8	82.8	26 - 152	33.599	33.8999	-0.3009	N/A	
13C12-1,2,3,6,7,8-HxCDF	1886.8	83.3	26 - 123	33.7437	34.04103	-0.2973	N/A	
13C12-2,3,4,6,7,8-HxCDF	1886.8	82.7	28 - 136	34.6462	34.93782	-0.2916	N/A	
13C12-1,2,3,7,8,9-HxCDF	1886.8	87.2	29 - 147	35.7047	35.97962	-0.2749	N/A	
13C12-1,2,3,4,7,8-HxCDD	1886.8	82.3	32 - 141	34.78	35.0678	-0.2878	N/A	
13C12-1,2,3,6,7,8-HxCDD	1886.8	80.2	28 - 130	34.9025	35.18663	-0.2841	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	1886.8	80.5	28 - 143	37.5985	37.86993	-0.2714	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	1886.8	79.0	26 - 138	39.7153	40.00348	-0.2882	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	1886.8	82.2	23 - 140	39.0358	39.31458	-0.2788	N/A	
13C12-OCDD	3773.6	81.2	17 - 157	43.3923	43.75875	-0.3665	N/A	
37Cl4-2,3,7,8-TCDD	754.72	87.2	35 - 197	25.1397	25.43467	-0.2950	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 1613B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0114	Instrument:	AUTOSPEC01
Sample ID:	SKD0114-CCV2	Calibration:	FC00062
File ID:	22040826	Analyzed:	04/09/22 07:22

Surrogate Compound	Spike Level ng/mL	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
13C12-2,3,7,8-TCDF	100.00	102	71 - 129	24.5048	24.76933	-0.2645	N/A	
13C12-2,3,7,8-TCDD	100.00	111	82 - 118	25.1398	25.4145	-0.2747	N/A	
13C12-1,2,3,7,8-PeCDF	100.00	98.1	76 - 124	28.619	28.8992	-0.2802	N/A	
13C12-2,3,4,7,8-PeCDF	100.00	98.4	77 - 123	29.956	30.24362	-0.2876	N/A	
13C12-1,2,3,7,8-PeCDD	100.00	100	62 - 138	30.2233	30.5054	-0.2821	N/A	
13C12-1,2,3,4,7,8-HxCDF	100.00	99.4	76 - 124	33.6102	33.8999	-0.2897	N/A	
13C12-1,2,3,6,7,8-HxCDF	100.00	101	70 - 130	33.755	34.04103	-0.2860	N/A	
13C12-2,3,4,6,7,8-HxCDF	100.00	101	73 - 127	34.6575	34.93782	-0.2803	N/A	
13C12-1,2,3,7,8,9-HxCDF	100.00	109	74 - 126	35.7158	35.97962	-0.2638	N/A	
13C12-1,2,3,4,7,8-HxCDD	100.00	97.0	85 - 115	34.7912	35.0678	-0.2766	N/A	
13C12-1,2,3,6,7,8-HxCDD	100.00	98.4	85 - 115	34.9138	35.18663	-0.2728	N/A	
13C12-1,2,3,4,6,7,8-HpCDF	100.00	100	78 - 122	37.6098	37.86993	-0.2601	N/A	
13C12-1,2,3,4,7,8,9-HpCDF	100.00	101	77 - 123	39.7265	40.00348	-0.2770	N/A	
13C12-1,2,3,4,6,7,8-HpCDD	100.00	102	82 - 118	39.0472	39.31458	-0.2674	N/A	
13C12-OCDD	200.00	110	48 - 152	43.4108	43.75875	-0.3479	N/A	
37Cl4-2,3,7,8-TCDD	10.000	99.0	79 - 121	25.155	25.43467	-0.2797	N/A	

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

HOLDING TIME SUMMARY

Analysis: EPA 1613B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21

Sample Name	Date Collected	Date Received	Date Prepared	Days to Prep	Max Days to Prep	Date Analyzed	Days to Analysis	Max Days to Analysis	Q
MW-CP1-032322 22C0456-01	03/23/22 14:26	03/24/22 13:35	04/02/22 06:55	9	365	04/08/22 16:04	6	365	
MW-CP1-032322-D 22C0456-02	03/23/22 14:36	03/24/22 13:35	04/02/22 06:55	9	365	04/08/22 16:52	6	365	
MW-CP2-032322 22C0456-03	03/23/22 13:26	03/24/22 13:35	04/02/22 06:55	9	365	04/08/22 17:40	6	365	
MW-CP3-032322 22C0456-04	03/23/22 13:25	03/24/22 13:35	04/02/22 06:55	9	365	04/08/22 18:28	6	365	
MW-CP4-032322 22C0456-05	03/23/22 12:06	03/24/22 13:35	04/02/22 06:55	9	365	04/08/22 19:16	7	365	
MW-CP5-032322 22C0456-06	03/23/22 12:25	03/24/22 13:35	04/02/22 06:55	9	365	04/08/22 20:04	7	365	
MW-CP6-032322 22C0456-07	03/23/22 11:15	03/24/22 13:35	04/02/22 06:55	9	365	04/08/22 20:52	7	365	
MW-CP7-032322 22C0456-08	03/23/22 11:06	03/24/22 13:35	04/02/22 06:55	9	365	04/08/22 23:23	7	365	
MW-VB3-032322 22C0456-09	03/23/22 09:36	03/24/22 13:35	04/02/22 06:55	9	365	04/09/22 00:11	7	365	
HCOO-B312-032322 22C0456-10	03/23/22 15:00	03/24/22 13:35	04/02/22 06:55	9	365	04/09/22 00:59	7	365	
MW-C1-VB1-032422 22C0456-11	03/24/22 12:33	03/24/22 13:35	04/02/22 06:55	8	365	04/09/22 01:47	7	365	
MW-C1-VB1-032422-D 22C0456-12	03/24/22 12:37	03/24/22 13:35	04/02/22 06:55	8	365	04/09/22 02:35	7	365	
MW-C1-VB2-032422 22C0456-15	03/24/22 10:30	03/24/22 13:35	04/02/22 06:55	8	365	04/09/22 03:23	7	365	

* Indicates hold time exceedance.

Analytical Resources, LLC
Analytical Chemists and Consultants

METHOD DETECTION AND REPORTING LIMITS

EPA 1613B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Matrix: Solid
Instrument: AUTOSPEC01

Analyte	MDL	RL	Units
2,3,7,8-TCDF	0.058	1.00	ng/kg
2,3,7,8-TCDD	0.150	1.00	ng/kg
1,2,3,7,8-PeCDF	0.240	1.00	ng/kg
2,3,4,7,8-PeCDF	0.220	1.00	ng/kg
1,2,3,7,8-PeCDD	0.170	1.00	ng/kg
1,2,3,4,7,8-HxCDF	0.280	1.00	ng/kg
1,2,3,6,7,8-HxCDF	0.200	1.00	ng/kg
2,3,4,6,7,8-HxCDF	0.170	1.00	ng/kg
1,2,3,7,8,9-HxCDF	0.190	1.00	ng/kg
1,2,3,4,7,8-HxCDD	0.170	1.00	ng/kg
1,2,3,6,7,8-HxCDD	0.180	1.00	ng/kg
1,2,3,7,8,9-HxCDD	0.220	1.00	ng/kg
1,2,3,4,6,7,8-HpCDF	0.210	1.00	ng/kg
1,2,3,4,7,8,9-HpCDF	0.240	1.00	ng/kg
1,2,3,4,6,7,8-HpCDD	0.560	2.50	ng/kg
OCDF	1.10	2.50	ng/kg
OCDD	4.60	10.0	ng/kg

Analytical Resources, LLC
Analytical Chemists and Consultants

METHOD DETECTION AND REPORTING LIMITS

EPA 1613B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Matrix: Water
Instrument: AUTOSPEC01

Analyte	MDL	RL	Units
2,3,7,8-TCDF	1.20	10.0	pg/L
2,3,7,8-TCDD	1.30	10.0	pg/L
1,2,3,7,8-PeCDF	4.20	10.0	pg/L
2,3,4,7,8-PeCDF	4.00	10.0	pg/L
1,2,3,7,8-PeCDD	4.00	10.0	pg/L
1,2,3,4,7,8-HxCDF	3.80	10.0	pg/L
1,2,3,6,7,8-HxCDF	3.90	10.0	pg/L
2,3,4,6,7,8-HxCDF	3.50	10.0	pg/L
1,2,3,7,8,9-HxCDF	3.60	10.0	pg/L
1,2,3,4,7,8-HxCDD	4.10	10.0	pg/L
1,2,3,6,7,8-HxCDD	3.80	10.0	pg/L
1,2,3,7,8,9-HxCDD	3.40	10.0	pg/L
1,2,3,4,6,7,8-HpCDF	11.0	20.0	pg/L
1,2,3,4,7,8,9-HpCDF	3.60	10.0	pg/L
1,2,3,4,6,7,8-HpCDD	6.00	10.0	pg/L
OCDF	16.0	20.0	pg/L
OCDD	39.0	50.0	pg/L
Total TCDF		10.0	pg/L
Total TCDD		10.0	pg/L
Total PeCDF		10.0	pg/L
Total PeCDD		10.0	pg/L
Total HxCDF		10.0	pg/L
Total HxCDD		10.0	pg/L
Total HpCDF		10.0	pg/L
Total HpCDD		10.0	pg/L

WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

CS3WT

Calibration and Verification Solution (EPA-1613CS3) combined with Window Defining and 2,3,7,8-TCDD Resolution Testing Congeners

PRODUCT CODE:	CS3WT
LOT NUMBER:	CS3WT0617
SOLVENT(S):	Nonane/Toluene
DATE PREPARED: (mm/dd/yyyy)	06/27/2017
LAST TESTED: (mm/dd/yyyy)	06/27/2017
EXPIRY DATE: (mm/dd/yyyy)	06/27/2024
RECOMMENDED STORAGE:	Store ampoule in a cool, dark place

G001361
1613 CS3WT CCAL STD
Expires 6/27/2024
Prepared By Joshua Rains 2/13/2018

DESCRIPTION:

CS3WT is a solution/mixture of native and $^{13}C_{12}$-labelled chlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs). The components and their concentrations are given in Table A.

CS3WT was designed and prepared to be used as a HRMS calibration standard according to U.S. EPA Method 1613B.

It is to be used for calibration verification in place of EPA-1613CS3 (Lot: 13CS30617). It also contains the PCDD and PCDF window defining congeners for a DB-5 (or equivalent) capillary column as well as the TCDD isomers required to test and confirm the resolution of 2,3,7,8-TCDD.

The individual ^{13}C-labelled PCDDs and PCDFs all have chemical purities of >98% and isotopic purities of ≥99%. The 2,3,7,8-$^{37}Cl_4$-tetrachlorodibenzo-p-dioxin has a chemical purity of >98% and an isotopic (^{37}Cl) purity of ≥95%. The individual native 2,3,7,8-substituted PCDD and PCDF congeners all have chemical purities of >98%; the other congeners (window defining and resolution testing) should only be considered semi-quantitative.

This current lot of CS3WT (CS3WT0617) is to be used with the 1613 calibration solutions having the following lot numbers:

PRODUCT CODE	LOT NUMBER
EPA-1613CS1	13CS10617
EPA-1613CS2	13CS20617
EPA-1613CS3	13CS30617
EPA-1613CS4	13CS40617
EPA-1613CS5	13CS50617
EPA-1613CSL	13CSL0617
EPA-1613CS0.5	13CS0.50617

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture
Figure 1: HRGC/HRMS Data (SIR; 10,000 mass resolving power)

ADDITIONAL INFORMATION:

- See page 3 for further details.
- Only the 2,3,7,8-substituted PCDDs and PCDFs should be used for quantitation. The other congeners (window defining and 2378-TCDD resolution testing) should be considered semi-quantitative (within ±20% of their design value). Impurities have been identified where possible.

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

HAZARDS:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Where possible, all of our products are synthesized using single-product unambiguous routes. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner, which further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2,...x_n on which it depends is:

$$u_c(y(x_1, x_2, ...x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) has been assigned to the quantitative analytes in this mixture. Conversely, semi-quantitative analytes have been assigned an uncertainty of ±20%.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly tested by an external ISO/IEC 17025 accredited calibration company. In addition, their calibration is verified prior to each weighing using calibrated NIST and/or NRC traceable external weights. All volumetric glassware used is calibrated, of Class A tolerance, and has been tested according to the appropriate ASTM procedures, which are ultimately traceable to NIST. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO GUIDE 34 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).

CALA Testing Accreditation No. A1226

ANAB ACCREDITED ISO GUIDE 34 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Table A: **CS3WT; Components and Concentrations (ng/ml, in nonane/4.5% toluene)**

QUANTITATIVE ANALYTES (ng/ml, ±5%)	
Native PCDDs & PCDFs:	
2,3,7,8-TCDD	10
2,3,7,8-TCDF	10
1,2,3,7,8-PeCDD	50
1,2,3,7,8-PeCDF	50
2,3,4,7,8-PeCDF	50
1,2,3,4,7,8-HxCDD	50
1,2,3,6,7,8-HxCDD	50
1,2,3,7,8,9-HxCDD	50
1,2,3,4,7,8-HxCDF	50
1,2,3,6,7,8-HxCDF	50
1,2,3,7,8,9-HxCDF	50
2,3,4,6,7,8-HxCDF	50
1,2,3,4,6,7,8-HpCDD *(WD)*	50
1,2,3,4,6,7,8-HpCDF *(WD)*	50
1,2,3,4,7,8,9-HpCDF *(WD)*	50
OCDD	100
OCDF	100
Labelled PCDDs & PCDFs:	
$^{13}C_{12}$-2,3,7,8-TCDD	100
$^{13}C_{12}$-2,3,7,8-TCDF	100
$^{13}C_{12}$-1,2,3,7,8-PeCDD	100
$^{13}C_{12}$-1,2,3,7,8-PeCDF	100
$^{13}C_{12}$-2,3,4,7,8-PeCDF	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	100
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	100
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	100
$^{13}C_{12}$-OCDD	200
Cleanup Standard:	
$^{37}Cl_4$-2,3,7,8-TCDD	10
Internal Standards:	
$^{13}C_{12}$-1,2,3,4-TCDD	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	100

SEMI-QUANTITATIVE ANALYTES (ng/ml, ±20%)	
Window Definers:*	
1,3,6,8-TCDD	10
1,2,8,9-TCDD	10
1,3,6,8-TCDF	10
1,2,8,9-TCDF	10
1,2,4,6,8/1,2,4,7,9-PeCDD	50
1,2,3,8,9-PeCDD	50
1,3,4,6,8-PeCDF	50
1,2,3,8,9-PeCDF	50
1,2,4,6,7,9-HxCDD	50
1,2,3,4,6,8-HxCDF	50
1,2,3,4,6,7,9-HpCDD	50
2378-TCDD Resolution Testing Isomers:	
1,2,3,4-TCDD	5
1,2,3,7/1,2,3,8-TCDD	5
1,2,3,9-TCDD	10

** 1,2,3,4,6,7-HxCDD (last eluting HxCDD) not included; coelutes with 1,2,3,7,8,9-HxCDD. Use 1,2,3,4,6,7,9-HpCDD to set window.*

** 1,2,3,4,8,9-HxCDF (last eluting HxCDF) not included; can interfere with 1,2,3,7,8,9-HxCDF. Use 1,2,3,4,6,7,8-HpCDF to set window.*

WD – Window Definer

Certified By: _____ **Date:** 07/19/2017 (mm/dd/yyyy)

B.G. Chittim, General Manager

Figure 1: **CS3WT; HRGC/HRMS Data (60 m DB-5 Column)**

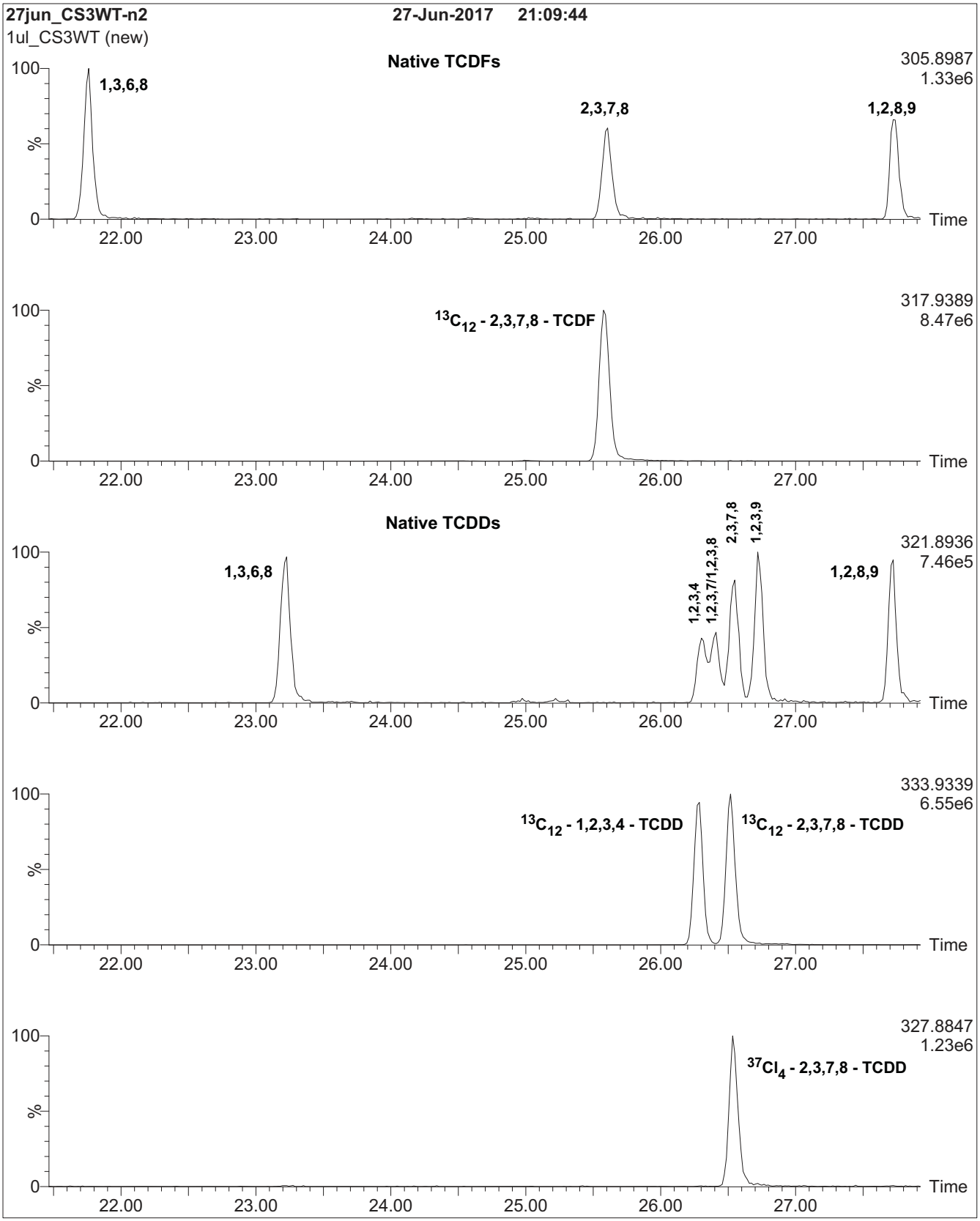


Figure 1: **CS3WT; HRGC/HRMS Data (60 m DB-5 Column)**

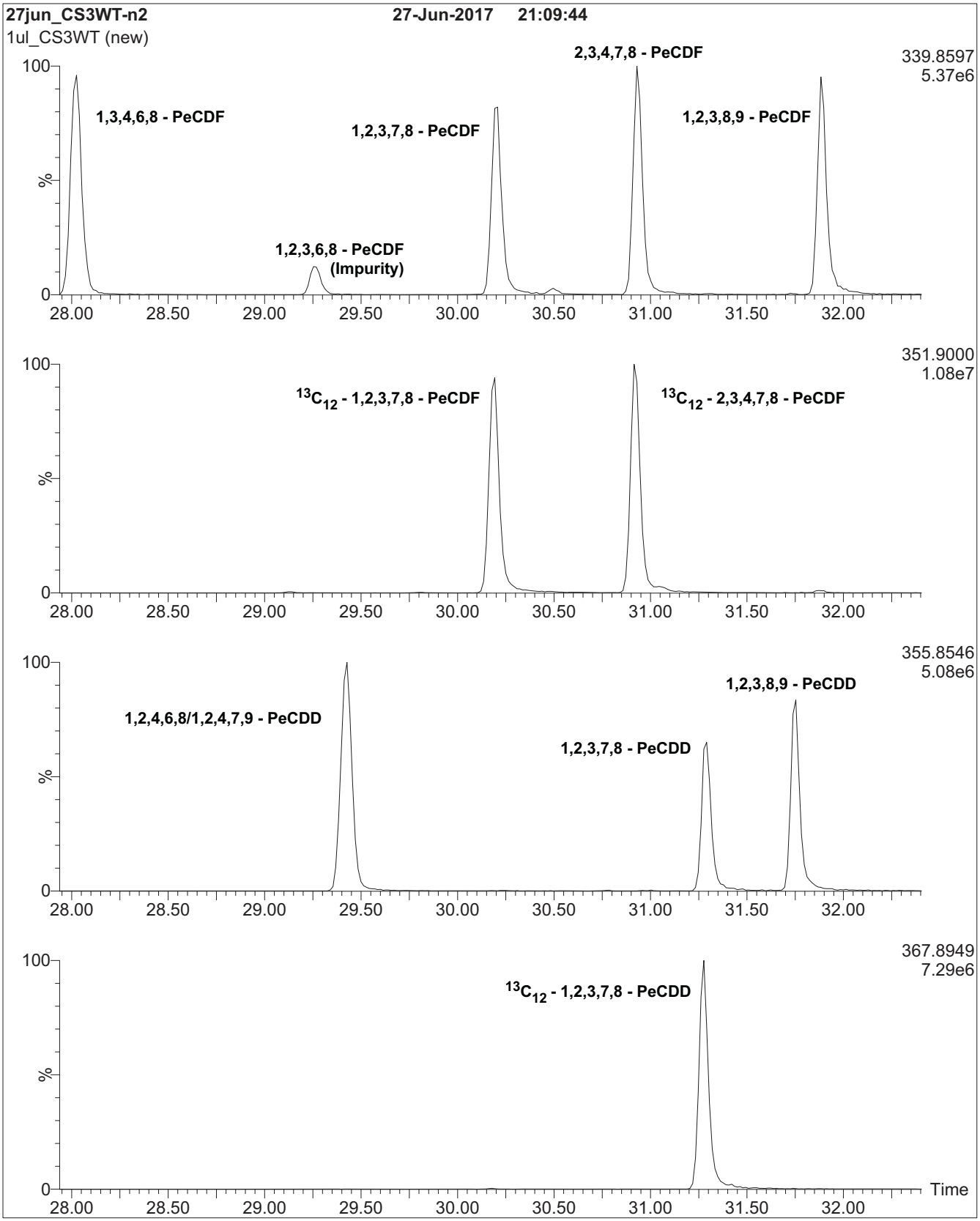


Figure 1: **CS3WT; HRGC/HRMS Data (60 m DB-5 Column)**

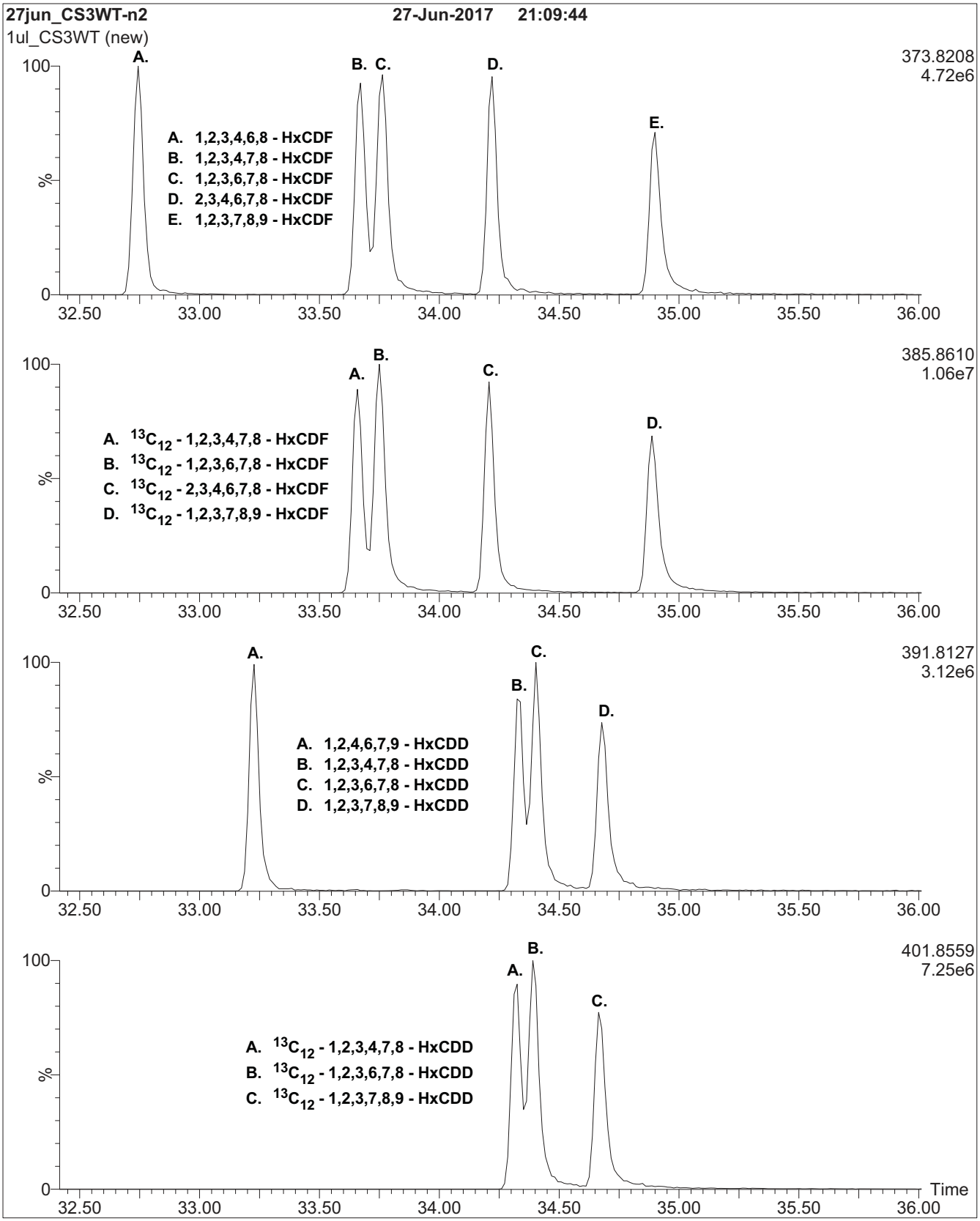


Figure 1: **CS3WT; HRGC/HRMS Data (60 m DB-5 Column)**

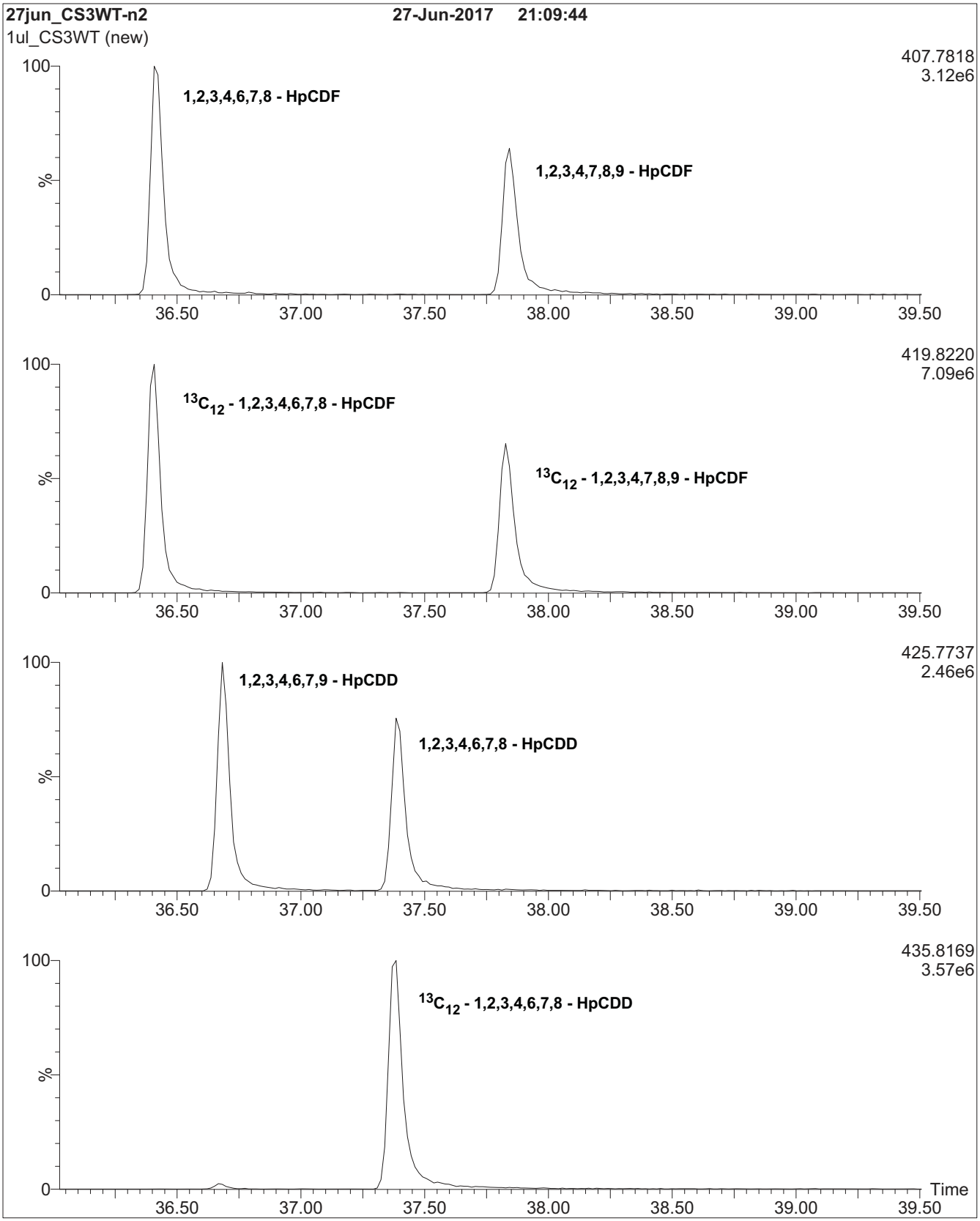
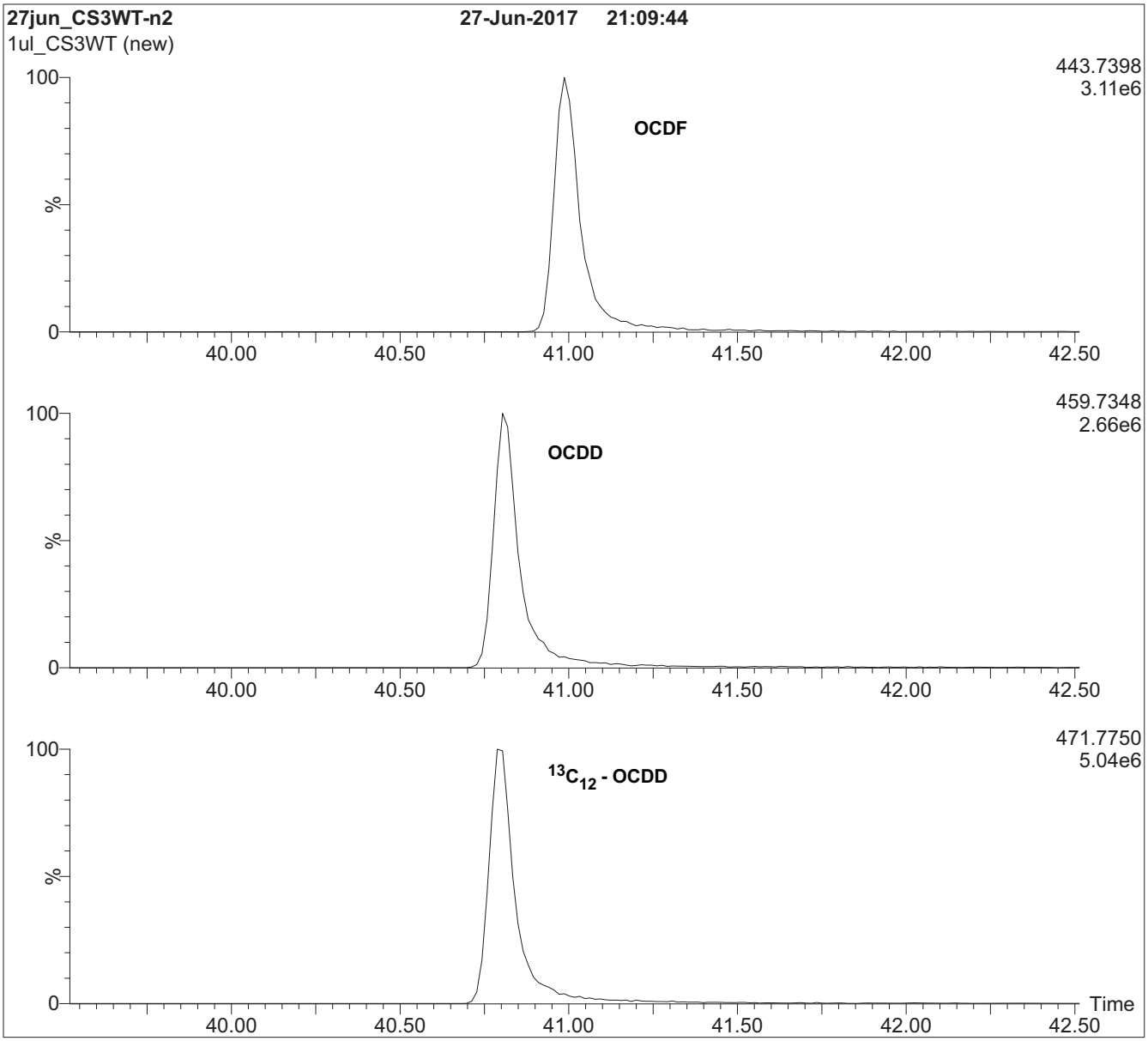


Figure 1: **CS3WT; HRGC/HRMS Data (60 m DB-5 Column)**



HRGC/HRMS:

Agilent 6890N (HRGC)
Autospec Ultima (HRMS)

Chromatographic Conditions:

Column: 60 m DB-5 (0.25 mm id, 0.25 µm film thickness) Agilent J&W

Flow:	Constant at 1 ml/min	Oven:	150 °C (1 min)
Injector:	280 °C (Splitless Injection)		12 °C/min to 200 °C
Ionization:	EI+		3 °C/min to 235 °C
Detector:	280 °C		235 °C (8 min)
	SIR at 10,000 mass resolving power		8 °C/min to 310 °C
			310 °C (8 min)

WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

EPA-1613PAR

U.S. EPA Method 1613 Native PCDD/PCDF
Precision and Recovery Stock Solution

PRODUCT CODE:	EPA-1613PAR
LOT NUMBER:	13PAR1019
SOLVENT(S):	Nonane/Toluene
DATE PREPARED: (mm/dd/yyyy)	10/16/2019
LAST TESTED: (mm/dd/yyyy)	10/17/2019
EXPIRY DATE: (mm/dd/yyyy)	10/17/2026
RECOMMENDED STORAGE:	Store ampoule in a cool, dark place

I000197
1613B Stock OPR Std-40/200/400ng/mL
Expires 10/17/2026
Prepared By Joshua Rains 1/8/2020

DESCRIPTION:

EPA-1613PAR is a solution/mixture of all the 2,3,7,8-substituted chlorinated dibenzo-p-dioxins (PCDDs) and 2,3,7,8-substituted dibenzofurans (PCDFs). The components and their concentrations are given in Table A.

EPA-1613PAR was designed for, and prepared to be used according to, U.S. EPA Method 1613 (Revision B).

The individual PCDDs and PCDFs all have chemical purities of >98%.

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution/Mixture
Figure 1: HRGC/HRMS Data (SIR; 10,000 mass resolving power)

ADDITIONAL INFORMATION:

- See page 2 for further details.

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519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2,...x_n on which it depends is:

$$u_c(y(x_1, x_2, ...x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO 17034 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).

CALA Testing Accreditation No. A1226

ANAB ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

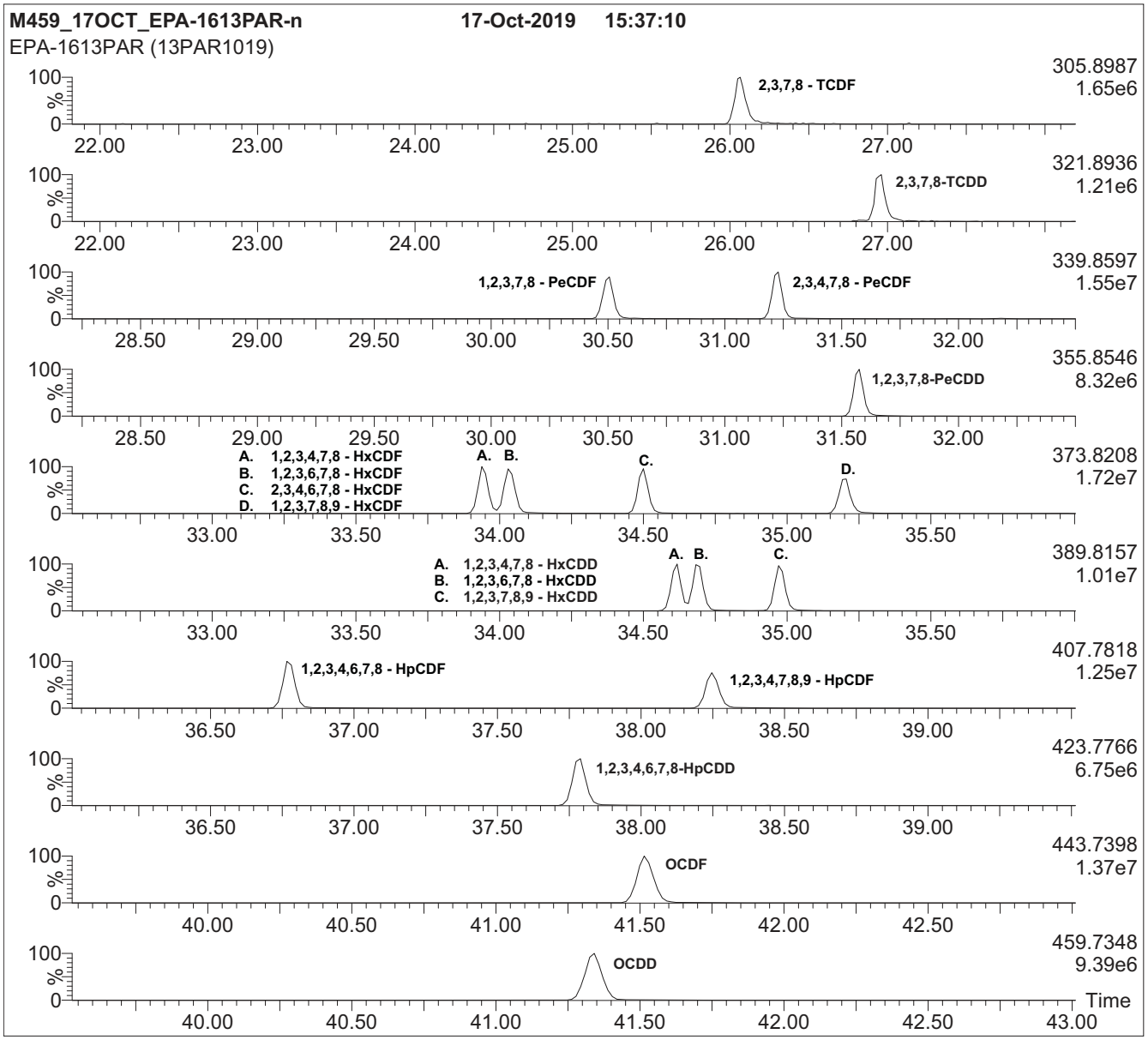
For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Table A: **EPA-1613PAR; Components and Concentrations (ng/ml, ± 5% in nonane/ 2.4% toluene)**

Component	Concentration (ng/ml)
PCDDs:	
2,3,7,8-Tetrachlorodibenzo-p-dioxin	40
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	200
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	200
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	200
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	200
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	200
Octachlorodibenzo-p-dioxin	400
PCDFs:	
2,3,7,8-Tetrachlorodibenzofuran	40
1,2,3,7,8-Pentachlorodibenzofuran	200
2,3,4,7,8-Pentachlorodibenzofuran	200
1,2,3,4,7,8-Hexachlorodibenzofuran	200
1,2,3,6,7,8-Hexachlorodibenzofuran	200
1,2,3,7,8,9-Hexachlorodibenzofuran	200
2,3,4,6,7,8-Hexachlorodibenzofuran	200
1,2,3,4,6,7,8-Heptachlorodibenzofuran	200
1,2,3,4,7,8,9-Heptachlorodibenzofuran	200
Octachlorodibenzofuran	400

Certified By: _____ **Date:** 11/07/2019
(mm/dd/yyyy)
B.G. Chittim, General Manager

Figure 1: **EPA-1613PAR; HRGC/HRMS Data (60 m DB-5 Column)**



HRGC/HRMS:

Agilent 6890N (HRGC)
Autospec Ultima (HRMS)

Chromatographic Conditions:

Column: 60 m DB-5 (0.25 mm id, 0.25 µm film thickness) Agilent J&W

Flow:	Constant at 1 ml/min	Oven:	150 °C (1 min)
Injector:	280 °C (Splitless Injection)		12 °C/min to 200 °C
Ionization:	EI+		3 °C/min to 235 °C
Detector:	280 °C		235 °C (8 min)
	SIR at 10,000 mass resolving power		8 °C/min to 310 °C
			310 °C (8 min)

WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

EPA-1613CVS

U.S. EPA Method 1613 Calibration and Verification Solutions
plus Supplemental Calibration Solutions EPA-1613CSL & EPA-1613CS0.5

PRODUCT CODES:	EPA-1613CVS	**LOT NUMBERS:**	(see below)
	EPA-1613CS1		13CS11019
	EPA-1613CS2		13CS21019
	EPA-1613CS3		13CS31019
	EPA-1613CS4		13CS41019
	EPA-1613CS5		13CS51019

Note: EPA-1613CSL and EPA-1613CS0.5 are lower level extensions to this calibration set that must be ordered separately.

EPA-1613CS0.5	13CS0.51019
EPA-1613CSL	13CSL1019

SOLVENT(S):	Nonane/Toluene
DATE PREPARED: (mm/dd/yyyy)	10/22/2019
LAST TESTED: (mm/dd/yyyy)	10/24/2019
EXPIRY DATE: (mm/dd/yyyy)	10/24/2026
RECOMMENDED STORAGE:	Store ampoules in a cool, dark place

I005456
1613 CS1 CAL STD
Expires 10/24/2026
Prepared By Joshua Rains 6/23/2020

DESCRIPTION:

EPA-1613CVS is a series of 5 calibration solutions containing native ($^{12}C_{12}$) and mass-labelled ($^{13}C_{12}$ and $^{37}Cl_4$) chlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs). The components of each solution, and their concentrations, are given in Table A.

They were designed for, and prepared to be used according to, U.S. EPA Method 1613 (Revision B). They are to be used as received.

EPA-1613CSL and EPA-1613CS0.5 are lower level extensions to EPA-1613CVS. Neither is required by the method, but either or both can be used to extend the calibration to lower levels.

The individual native PCDDs and PCDFs all have chemical purities of >98%. The individual ^{13}C-labelled PCDDs and PCDFs all have chemical purities of >98% and isotopic purities of ≥99%. The 2,3,7,8-$^{37}Cl_4$-Tetrachlorodibenzo-p-dioxin has a chemical purity of >98% and an isotopic (^{37}Cl) purity of ≥95%.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations
Table B: 5-point HRGC/HRMS Calibration and RRF Summary
Table C: 7-point HRGC/HRMS Calibration and RRF Summary
Figure 1: HRGC/HRMS Data for EPA-1613CS3 (SIR; 10,000 mass resolving power)

ADDITIONAL INFORMATION:

- See page 3 for further details.

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a series of standards for the identification and quantification of specific chemical compounds.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned values, and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2,...x_n on which it depends is:

$$u_c(y(x_1, x_2, ...x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analytes is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO 17034 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).

CALA Testing Accreditation No. A 1226

ANAB ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Table A: **EPA-1613CVS (with EPA-1613CSL and EPA-1613CS0.5); Components and Concentrations (ng/ml, ± 5% in nonane/toluene)**

Compound	Concentration (ng/ml)						
Native PCDDs and PCDFs:	**CS1**	**CS2**	**CS3**	**CS4**	**CS5**	**CSL**	**CS0.5**
2,3,7,8-TCDD	0.5	2	10	40	200	0.1	0.25
2,3,7,8-TCDF	0.5	2	10	40	200	0.1	0.25
1,2,3,7,8-PeCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8-PeCDF	2.5	10	50	200	1000	0.5	1.25
2,3,4,7,8-PeCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,6,7,8-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8,9-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,6,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8,9-HxCDF	2.5	10	50	200	1000	0.5	1.25
2,3,4,6,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,6,7,8-HpCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,6,7,8-HpCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8,9-HpCDF	2.5	10	50	200	1000	0.5	1.25
OCDD	5.0	20	100	400	2000	1.0	2.5
OCDF	5.0	20	100	400	2000	1.0	2.5
Labelled PCDDs and PCDFs:							
$^{13}C_{12}$-2,3,7,8-TCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,7,8-TCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8-PeCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8-PeCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,4,7,8-PeCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-OCDD	200	200	200	200	200	200	200
Cleanup Standard:							
$^{37}Cl_4$-2,3,7,8-TCDD	0.5	2	10	40	200	0.1	0.25
Internal Standards:							
$^{13}C_{12}$-1,2,3,4-TCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	100	100	100	100	100	100	100
Percent toluene (v/v)	3.6%	3.7%	4.2%	6.1%	16.2%	3.6%	3.6%

Certified By: _____ **Date:** 10/25/2019
(mm/dd/yyyy)

B.G. Chittim, General Manager

Table B: **EPA-1613CVS; 5-point HRGC/HRMS Calibration and RRF Summary**

Calibration RRF Summary				Calibration Standard				
Calibration Filename: 24oct_EPA1613CVS-CAL.QLD				CS1	CS2	CS3	CS4	CS5
Name	Mean	S. D.	%RSD	RRF#1	RRF#2	RRF#3	RRF#4	RRF#5
2,3,7,8-TCDF	0.93	0.013	1.4	0.92	0.95	0.93	0.92	0.95
1,2,3,7,8-PeCDF	0.93	0.015	1.6	0.92	0.92	0.93	0.93	0.95
2,3,4,7,8-PeCDF	1.04	0.019	1.8	1.03	1.02	1.05	1.05	1.07
1,2,3,4,7,8-HxCDF	0.96	0.035	3.7	0.94	0.92	0.98	0.99	1.00
1,2,3,6,7,8-HxCDF	0.93	0.013	1.4	0.92	0.94	0.94	0.91	0.94
2,3,4,6,7,8-HxCDF	0.96	0.022	2.3	0.95	0.94	0.97	0.97	0.99
1,2,3,7,8,9-HxCDF	0.89	0.021	2.4	0.87	0.88	0.90	0.90	0.92
1,2,3,4,6,7,8-HpCDF	0.91	0.011	1.2	0.90	0.90	0.90	0.92	0.92
1,2,3,4,7,8,9-HpCDF	0.91	0.010	1.1	0.90	0.90	0.92	0.91	0.92
OCDF	1.19	0.056	4.7	1.11	1.17	1.19	1.23	1.26
2,3,7,8-TCDD	1.05	0.023	2.2	1.01	1.06	1.05	1.05	1.07
1,2,3,7,8-PeCDD	0.97	0.018	1.9	0.95	0.95	0.98	0.97	0.99
1,2,3,4,7,8-HxCDD	1.00	0.019	1.9	1.01	1.00	1.00	0.96	1.01
1,2,3,6,7,8-HxCDD	0.98	0.032	3.2	0.93	0.98	0.99	1.01	1.01
1,2,3,7,8,9-HxCDD	0.97	0.016	1.6	0.95	0.96	0.98	0.99	0.98
1,2,3,4,6,7,8-HpCDD	1.01	0.025	2.5	1.01	0.97	1.02	1.03	1.04
OCDD	1.00	0.013	1.3	1.00	0.99	1.02	1.02	1.00
$^{13}C_{12}$-2,3,7,8-TCDF	1.57	0.047	3.0	1.52	1.55	1.55	1.57	1.65
$^{13}C_{12}$-1,2,3,7,8-PeCDF	1.21	0.078	6.5	1.13	1.20	1.17	1.20	1.34
$^{13}C_{12}$-2,3,4,7,8-PeCDF	1.17	0.081	6.9	1.09	1.15	1.13	1.17	1.31
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1.33	0.020	1.5	1.35	1.33	1.33	1.32	1.30
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	1.51	0.034	2.2	1.47	1.48	1.53	1.53	1.54
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	1.38	0.012	0.9	1.38	1.38	1.40	1.37	1.36
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	1.19	0.014	1.2	1.18	1.16	1.20	1.19	1.20
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1.31	0.033	2.5	1.31	1.26	1.33	1.31	1.35
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	1.08	0.046	4.3	1.06	1.03	1.09	1.08	1.15
$^{13}C_{12}$-2,3,7,8-TCDD	1.13	0.036	3.2	1.10	1.11	1.11	1.13	1.19
$^{13}C_{12}$-1,2,3,7,8-PeCDD	0.79	0.047	5.9	0.74	0.78	0.75	0.79	0.86
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	0.87	0.027	3.1	0.85	0.83	0.89	0.88	0.89
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1.04	0.010	1.0	1.05	1.05	1.04	1.05	1.03
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	0.81	0.017	2.1	0.81	0.80	0.80	0.81	0.84
$^{13}C_{12}$-OCDD	0.74	0.055	7.4	0.70	0.70	0.73	0.72	0.83
$^{13}C_{12}$-1,2,3,4-TCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00
$^{37}Cl_4$-2,3,7,8-TCDD	0.97	0.026	2.6	0.95	0.94	0.99	0.99	0.99

Table C: **EPA-1613CVS (with EPA-1613CSL and EPA-1613CS0.5); 7-point HRGC/HRMS Calibration and RRF Summary**

Calibration RRF Summary				Calibration Standard						
Calibration Filename: 24oct_EPA1613CVS-CAL.QLD				CSL	CS0.5	CS1	CS2	CS3	CS4	CS5
Name	Mean	S. D.	%RSD	RRF#1	RRF#2	RRF#3	RRF#4	RRF#5	RRF#6	RRF#7
2,3,7,8-TCDF	0.92	0.045	4.8	0.96	0.83	0.92	0.95	0.93	0.92	0.95
1,2,3,7,8-PeCDF	0.93	0.013	1.4	0.94	0.92	0.92	0.92	0.93	0.93	0.95
2,3,4,7,8-PeCDF	1.02	0.058	5.7	0.90	1.00	1.03	1.02	1.05	1.05	1.07
1,2,3,4,7,8-HxCDF	0.96	0.029	3.0	0.96	0.97	0.94	0.92	0.98	0.99	1.00
1,2,3,6,7,8-HxCDF	0.92	0.030	3.3	0.90	0.86	0.92	0.94	0.94	0.91	0.94
2,3,4,6,7,8-HxCDF	0.94	0.047	5.0	0.87	0.89	0.95	0.94	0.97	0.97	0.99
1,2,3,7,8,9-HxCDF	0.88	0.029	3.3	0.83	0.88	0.87	0.88	0.90	0.90	0.92
1,2,3,4,6,7,8-HpCDF	0.90	0.033	3.7	0.83	0.93	0.90	0.90	0.90	0.92	0.92
1,2,3,4,7,8,9-HpCDF	0.91	0.018	1.9	0.89	0.94	0.90	0.90	0.92	0.91	0.92
OCDF	1.18	0.052	4.4	1.15	1.14	1.11	1.17	1.19	1.23	1.26
2,3,7,8-TCDD	1.03	0.051	5.0	1.03	0.92	1.01	1.06	1.05	1.05	1.07
1,2,3,7,8-PeCDD	0.95	0.042	4.4	0.87	0.98	0.95	0.95	0.98	0.97	0.99
1,2,3,4,7,8-HxCDD	0.97	0.066	6.8	0.83	0.98	1.01	1.00	1.00	0.96	1.01
1,2,3,6,7,8-HxCDD	0.96	0.044	4.5	0.90	0.92	0.93	0.98	0.99	1.01	1.01
1,2,3,7,8,9-HxCDD	0.94	0.054	5.7	0.83	0.92	0.95	0.96	0.98	0.99	0.98
1,2,3,4,6,7,8-HpCDD	1.01	0.033	3.3	0.95	1.03	1.01	0.97	1.02	1.03	1.04
OCDD	1.00	0.023	2.3	0.95	1.00	1.00	0.99	1.02	1.02	1.00
$^{13}C_{12}$-2,3,7,8-TCDF	1.56	0.042	2.7	1.52	1.54	1.52	1.55	1.55	1.57	1.65
$^{13}C_{12}$-1,2,3,7,8-PeCDF	1.20	0.066	5.5	1.18	1.17	1.13	1.20	1.17	1.20	1.34
$^{13}C_{12}$-2,3,4,7,8-PeCDF	1.16	0.071	6.1	1.12	1.13	1.09	1.15	1.13	1.17	1.31
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1.33	0.018	1.4	1.32	1.35	1.35	1.33	1.33	1.32	1.30
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	1.53	0.045	3.0	1.60	1.56	1.47	1.48	1.53	1.53	1.54
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	1.39	0.019	1.4	1.39	1.42	1.38	1.38	1.40	1.37	1.36
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	1.19	0.012	1.0	1.19	1.19	1.18	1.16	1.20	1.19	1.20
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1.31	0.028	2.2	1.30	1.33	1.31	1.26	1.33	1.31	1.35
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	1.07	0.045	4.2	1.02	1.08	1.06	1.03	1.09	1.08	1.15
$^{13}C_{12}$-2,3,7,8-TCDD	1.12	0.033	3.0	1.09	1.11	1.10	1.11	1.11	1.13	1.19
$^{13}C_{12}$-1,2,3,7,8-PeCDD	0.78	0.040	5.1	0.75	0.78	0.74	0.78	0.75	0.79	0.86
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	0.87	0.025	2.9	0.86	0.90	0.85	0.83	0.89	0.88	0.89
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1.05	0.015	1.5	1.08	1.06	1.05	1.05	1.04	1.05	1.03
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	0.81	0.016	2.0	0.79	0.81	0.81	0.80	0.80	0.81	0.84
$^{13}C_{12}$-OCDD	0.73	0.046	6.3	0.71	0.72	0.70	0.70	0.73	0.72	0.83
$^{13}C_{12}$-1,2,3,4-TCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$^{37}Cl_4$-2,3,7,8-TCDD	0.97	0.053	5.4	0.90	1.07	0.95	0.94	0.99	0.99	0.99

Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

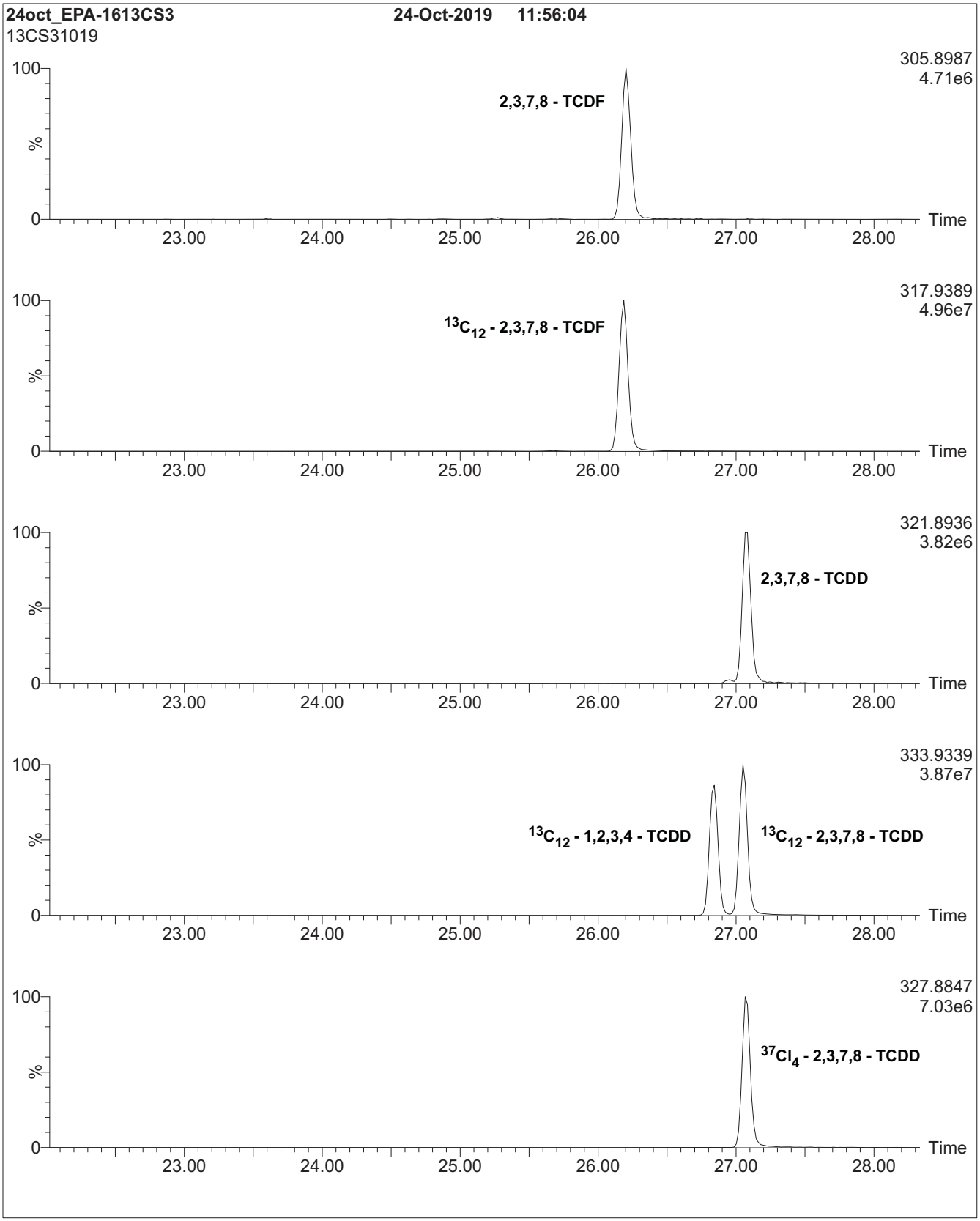


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

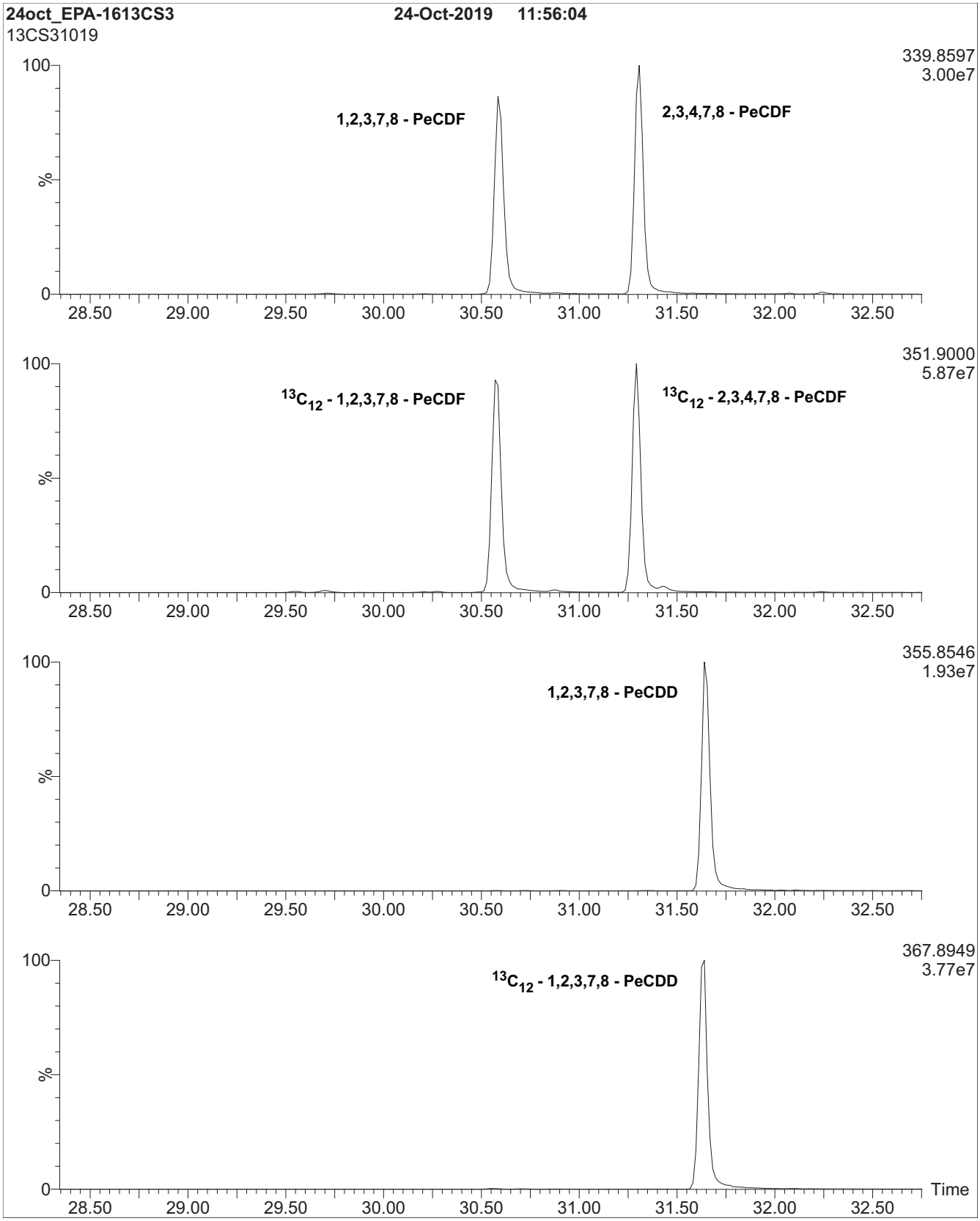


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

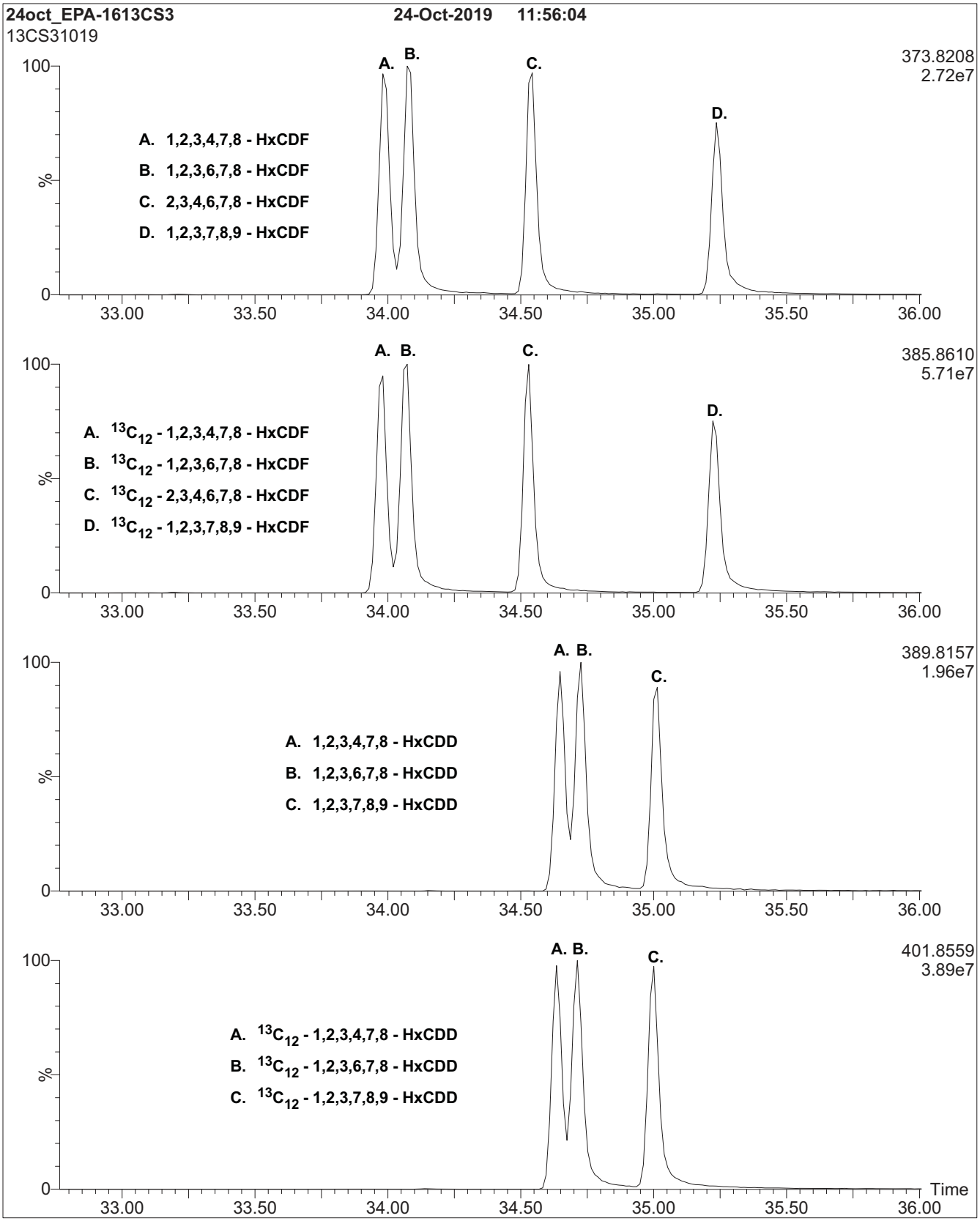


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

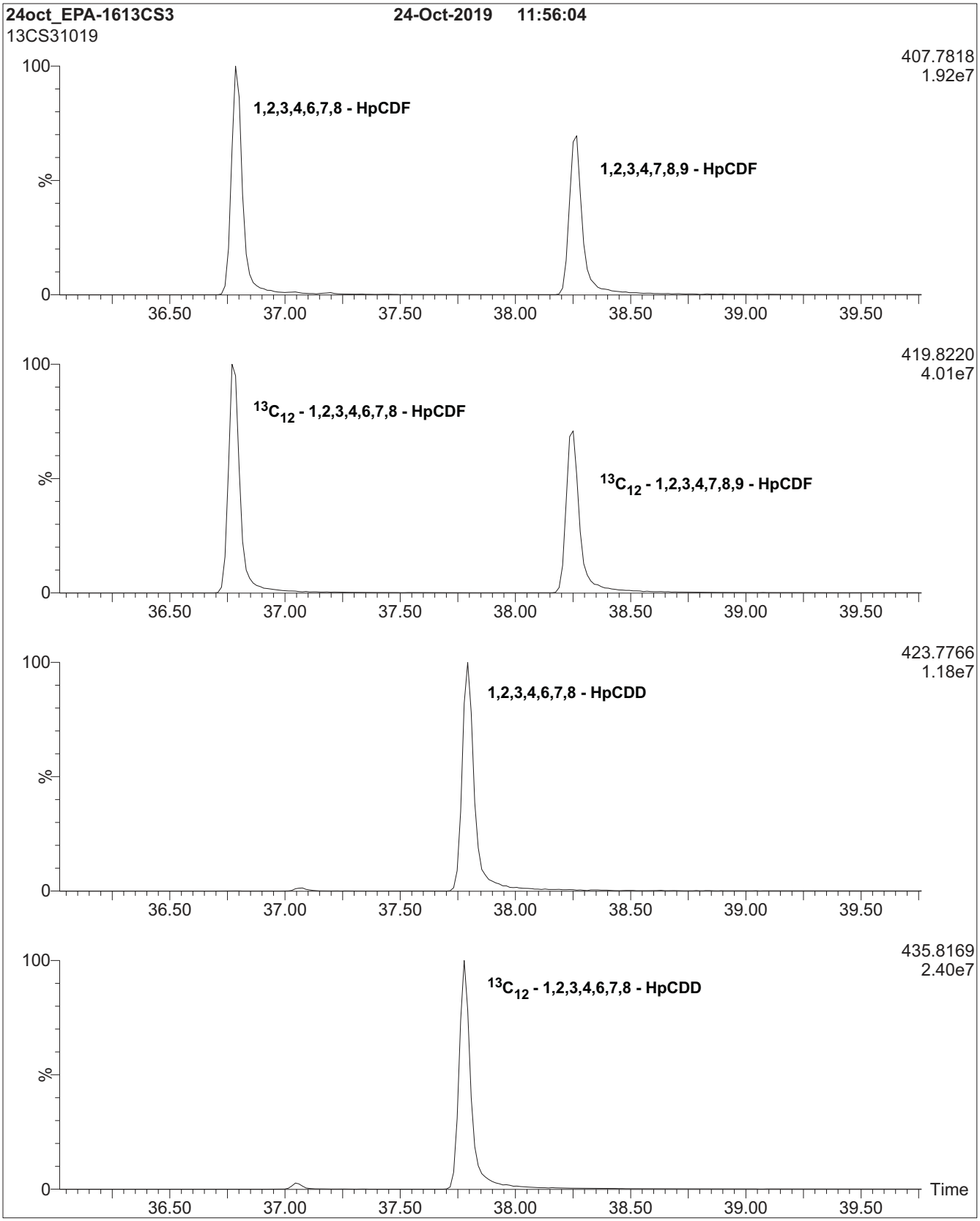
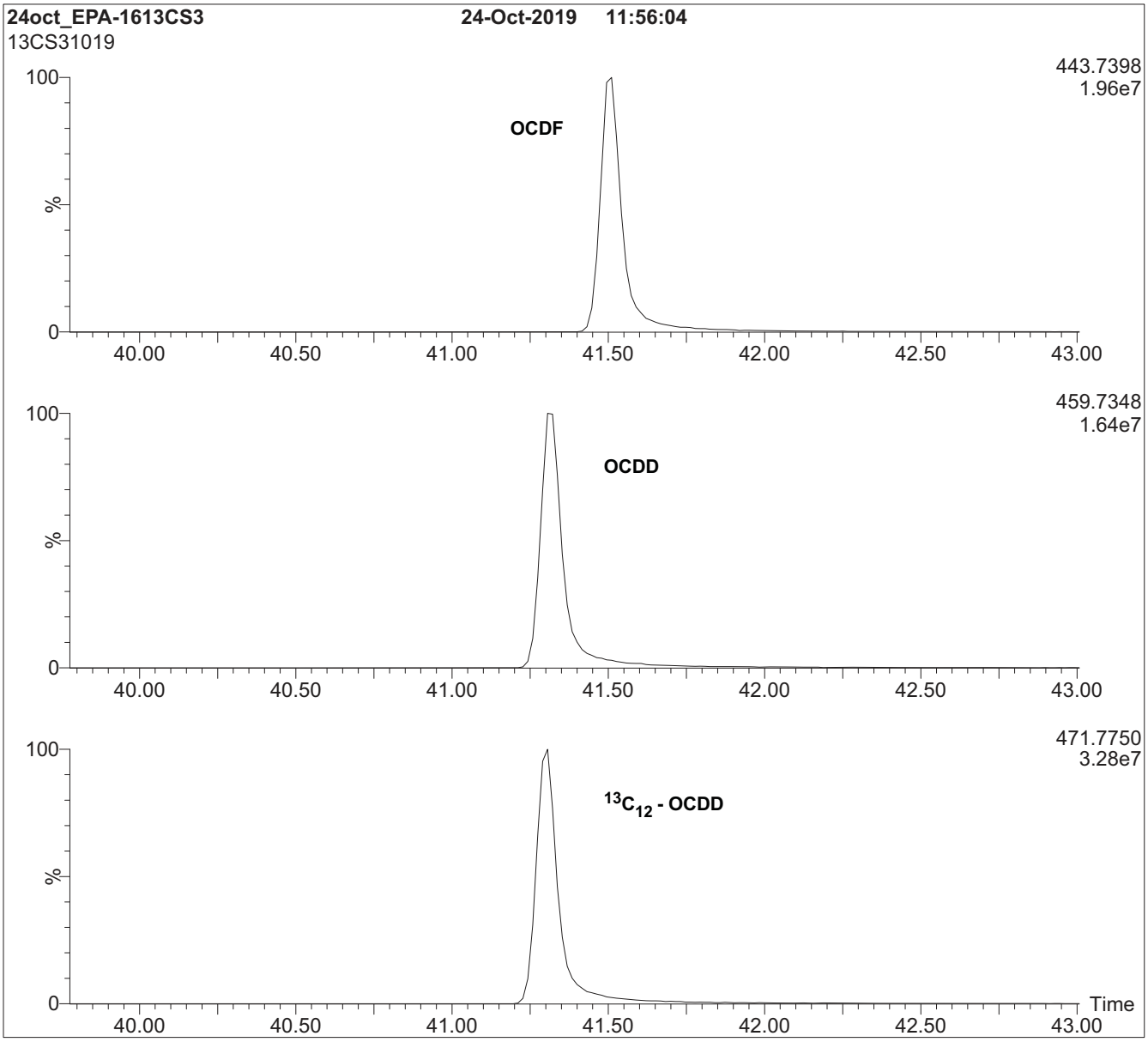


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**



HRGC/HRMS:

Agilent 6890N (HRGC)
Autospec Ultima (HRMS)

Chromatographic Conditions:

Column: 60 m DB-5 (0.25 mm id, 0.25 µm film thickness) Agilent J&W

Flow: Constant at 1 ml/min
Injector: 280 °C (Splitless Injection)
Ionization: EI+
Detector: 280 °C
SIR at 10,000 mass resolving power

Oven: 150 °C (1 min)
12 °C/min to 200 °C
3 °C/min to 235 °C
235 °C (8 min)
8 °C/min to 310 °C
310 °C (8 min)

WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

EPA-1613CVS

U.S. EPA Method 1613 Calibration and Verification Solutions
plus Supplemental Calibration Solutions EPA-1613CSL & EPA-1613CS0.5

PRODUCT CODES:	EPA-1613CVS	**LOT NUMBERS:**	(see below)
	EPA-1613CS1		13CS11019
	EPA-1613CS2		13CS21019
	EPA-1613CS3		13CS31019
	EPA-1613CS4		13CS41019
	EPA-1613CS5		13CS51019

Note: EPA-1613CSL and EPA-1613CS0.5 are lower level extensions to this calibration set that must be ordered separately.

EPA-1613CS0.5	13CS0.51019
EPA-1613CSL	13CSL1019

SOLVENT(S):	Nonane/Toluene
DATE PREPARED: (mm/dd/yyyy)	10/22/2019
LAST TESTED: (mm/dd/yyyy)	10/24/2019
EXPIRY DATE: (mm/dd/yyyy)	10/24/2026
RECOMMENDED STORAGE:	Store ampoules in a cool, dark place

I005457
1613 CS2 CAL STD
Expires 10/24/2026
Prepared By Joshua Rains 6/23/2020

DESCRIPTION:

EPA-1613CVS is a series of 5 calibration solutions containing native ($^{12}C_{12}$) and mass-labelled ($^{13}C_{12}$ and $^{37}Cl_4$) chlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs). The components of each solution, and their concentrations, are given in Table A.

They were designed for, and prepared to be used according to, U.S. EPA Method 1613 (Revision B). They are to be used as received.

EPA-1613CSL and EPA-1613CS0.5 are lower level extensions to EPA-1613CVS. Neither is required by the method, but either or both can be used to extend the calibration to lower levels.

The individual native PCDDs and PCDFs all have chemical purities of >98%. The individual ^{13}C-labelled PCDDs and PCDFs all have chemical purities of >98% and isotopic purities of ≥99%. The 2,3,7,8-$^{37}Cl_4$-Tetrachlorodibenzo-p-dioxin has a chemical purity of >98% and an isotopic (^{37}Cl) purity of ≥95%.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations
Table B: 5-point HRGC/HRMS Calibration and RRF Summary
Table C: 7-point HRGC/HRMS Calibration and RRF Summary
Figure 1: HRGC/HRMS Data for EPA-1613CS3 (SIR; 10,000 mass resolving power)

ADDITIONAL INFORMATION:

- See page 3 for further details.

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a series of standards for the identification and quantification of specific chemical compounds.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned values, and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2,...x_n on which it depends is:

$$u_c(y(x_1, x_2, ...x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analytes is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO 17034 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).

CALA Testing Accreditation No. A 1226

ANAB ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Table A: **EPA-1613CVS (with EPA-1613CSL and EPA-1613CS0.5); Components and Concentrations (ng/ml, ± 5% in nonane/toluene)**

Compound	Concentration (ng/ml)						
Native PCDDs and PCDFs:	**CS1**	**CS2**	**CS3**	**CS4**	**CS5**	**CSL**	**CS0.5**
2,3,7,8-TCDD	0.5	2	10	40	200	0.1	0.25
2,3,7,8-TCDF	0.5	2	10	40	200	0.1	0.25
1,2,3,7,8-PeCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8-PeCDF	2.5	10	50	200	1000	0.5	1.25
2,3,4,7,8-PeCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,6,7,8-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8,9-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,6,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8,9-HxCDF	2.5	10	50	200	1000	0.5	1.25
2,3,4,6,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,6,7,8-HpCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,6,7,8-HpCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8,9-HpCDF	2.5	10	50	200	1000	0.5	1.25
OCDD	5.0	20	100	400	2000	1.0	2.5
OCDF	5.0	20	100	400	2000	1.0	2.5
Labelled PCDDs and PCDFs:							
$^{13}C_{12}$-2,3,7,8-TCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,7,8-TCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8-PeCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8-PeCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,4,7,8-PeCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-OCDD	200	200	200	200	200	200	200
Cleanup Standard:							
$^{37}Cl_4$-2,3,7,8-TCDD	0.5	2	10	40	200	0.1	0.25
Internal Standards:							
$^{13}C_{12}$-1,2,3,4-TCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	100	100	100	100	100	100	100
Percent toluene (v/v)	3.6%	3.7%	4.2%	6.1%	16.2%	3.6%	3.6%

Certified By: _____ **Date:** 10/25/2019
(mm/dd/yyyy)

B.G. Chittim, General Manager

Table B: **EPA-1613CVS; 5-point HRGC/HRMS Calibration and RRF Summary**

Calibration RRF Summary				Calibration Standard				
Calibration Filename: 24oct_EPA1613CVS-CAL.QLD				CS1	CS2	CS3	CS4	CS5
Name	Mean	S. D.	%RSD	RRF#1	RRF#2	RRF#3	RRF#4	RRF#5
2,3,7,8-TCDF	0.93	0.013	1.4	0.92	0.95	0.93	0.92	0.95
1,2,3,7,8-PeCDF	0.93	0.015	1.6	0.92	0.92	0.93	0.93	0.95
2,3,4,7,8-PeCDF	1.04	0.019	1.8	1.03	1.02	1.05	1.05	1.07
1,2,3,4,7,8-HxCDF	0.96	0.035	3.7	0.94	0.92	0.98	0.99	1.00
1,2,3,6,7,8-HxCDF	0.93	0.013	1.4	0.92	0.94	0.94	0.91	0.94
2,3,4,6,7,8-HxCDF	0.96	0.022	2.3	0.95	0.94	0.97	0.97	0.99
1,2,3,7,8,9-HxCDF	0.89	0.021	2.4	0.87	0.88	0.90	0.90	0.92
1,2,3,4,6,7,8-HpCDF	0.91	0.011	1.2	0.90	0.90	0.90	0.92	0.92
1,2,3,4,7,8,9-HpCDF	0.91	0.010	1.1	0.90	0.90	0.92	0.91	0.92
OCDF	1.19	0.056	4.7	1.11	1.17	1.19	1.23	1.26
2,3,7,8-TCDD	1.05	0.023	2.2	1.01	1.06	1.05	1.05	1.07
1,2,3,7,8-PeCDD	0.97	0.018	1.9	0.95	0.95	0.98	0.97	0.99
1,2,3,4,7,8-HxCDD	1.00	0.019	1.9	1.01	1.00	1.00	0.96	1.01
1,2,3,6,7,8-HxCDD	0.98	0.032	3.2	0.93	0.98	0.99	1.01	1.01
1,2,3,7,8,9-HxCDD	0.97	0.016	1.6	0.95	0.96	0.98	0.99	0.98
1,2,3,4,6,7,8-HpCDD	1.01	0.025	2.5	1.01	0.97	1.02	1.03	1.04
OCDD	1.00	0.013	1.3	1.00	0.99	1.02	1.02	1.00
$^{13}C_{12}$-2,3,7,8-TCDF	1.57	0.047	3.0	1.52	1.55	1.55	1.57	1.65
$^{13}C_{12}$-1,2,3,7,8-PeCDF	1.21	0.078	6.5	1.13	1.20	1.17	1.20	1.34
$^{13}C_{12}$-2,3,4,7,8-PeCDF	1.17	0.081	6.9	1.09	1.15	1.13	1.17	1.31
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1.33	0.020	1.5	1.35	1.33	1.33	1.32	1.30
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	1.51	0.034	2.2	1.47	1.48	1.53	1.53	1.54
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	1.38	0.012	0.9	1.38	1.38	1.40	1.37	1.36
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	1.19	0.014	1.2	1.18	1.16	1.20	1.19	1.20
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1.31	0.033	2.5	1.31	1.26	1.33	1.31	1.35
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	1.08	0.046	4.3	1.06	1.03	1.09	1.08	1.15
$^{13}C_{12}$-2,3,7,8-TCDD	1.13	0.036	3.2	1.10	1.11	1.11	1.13	1.19
$^{13}C_{12}$-1,2,3,7,8-PeCDD	0.79	0.047	5.9	0.74	0.78	0.75	0.79	0.86
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	0.87	0.027	3.1	0.85	0.83	0.89	0.88	0.89
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1.04	0.010	1.0	1.05	1.05	1.04	1.05	1.03
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	0.81	0.017	2.1	0.81	0.80	0.80	0.81	0.84
$^{13}C_{12}$-OCDD	0.74	0.055	7.4	0.70	0.70	0.73	0.72	0.83
$^{13}C_{12}$-1,2,3,4-TCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00
$^{37}Cl_4$-2,3,7,8-TCDD	0.97	0.026	2.6	0.95	0.94	0.99	0.99	0.99

Table C: **EPA-1613CVS (with EPA-1613CSL and EPA-1613CS0.5); 7-point HRGC/HRMS Calibration and RRF Summary**

Calibration RRF Summary				Calibration Standard						
Calibration Filename: 24oct_EPA1613CVS-CAL.QLD				CSL	CS0.5	CS1	CS2	CS3	CS4	CS5
Name	Mean	S. D.	%RSD	RRF#1	RRF#2	RRF#3	RRF#4	RRF#5	RRF#6	RRF#7
2,3,7,8-TCDF	0.92	0.045	4.8	0.96	0.83	0.92	0.95	0.93	0.92	0.95
1,2,3,7,8-PeCDF	0.93	0.013	1.4	0.94	0.92	0.92	0.92	0.93	0.93	0.95
2,3,4,7,8-PeCDF	1.02	0.058	5.7	0.90	1.00	1.03	1.02	1.05	1.05	1.07
1,2,3,4,7,8-HxCDF	0.96	0.029	3.0	0.96	0.97	0.94	0.92	0.98	0.99	1.00
1,2,3,6,7,8-HxCDF	0.92	0.030	3.3	0.90	0.86	0.92	0.94	0.94	0.91	0.94
2,3,4,6,7,8-HxCDF	0.94	0.047	5.0	0.87	0.89	0.95	0.94	0.97	0.97	0.99
1,2,3,7,8,9-HxCDF	0.88	0.029	3.3	0.83	0.88	0.87	0.88	0.90	0.90	0.92
1,2,3,4,6,7,8-HpCDF	0.90	0.033	3.7	0.83	0.93	0.90	0.90	0.90	0.92	0.92
1,2,3,4,7,8,9-HpCDF	0.91	0.018	1.9	0.89	0.94	0.90	0.90	0.92	0.91	0.92
OCDF	1.18	0.052	4.4	1.15	1.14	1.11	1.17	1.19	1.23	1.26
2,3,7,8-TCDD	1.03	0.051	5.0	1.03	0.92	1.01	1.06	1.05	1.05	1.07
1,2,3,7,8-PeCDD	0.95	0.042	4.4	0.87	0.98	0.95	0.95	0.98	0.97	0.99
1,2,3,4,7,8-HxCDD	0.97	0.066	6.8	0.83	0.98	1.01	1.00	1.00	0.96	1.01
1,2,3,6,7,8-HxCDD	0.96	0.044	4.5	0.90	0.92	0.93	0.98	0.99	1.01	1.01
1,2,3,7,8,9-HxCDD	0.94	0.054	5.7	0.83	0.92	0.95	0.96	0.98	0.99	0.98
1,2,3,4,6,7,8-HpCDD	1.01	0.033	3.3	0.95	1.03	1.01	0.97	1.02	1.03	1.04
OCDD	1.00	0.023	2.3	0.95	1.00	1.00	0.99	1.02	1.02	1.00
$^{13}C_{12}$-2,3,7,8-TCDF	1.56	0.042	2.7	1.52	1.54	1.52	1.55	1.55	1.57	1.65
$^{13}C_{12}$-1,2,3,7,8-PeCDF	1.20	0.066	5.5	1.18	1.17	1.13	1.20	1.17	1.20	1.34
$^{13}C_{12}$-2,3,4,7,8-PeCDF	1.16	0.071	6.1	1.12	1.13	1.09	1.15	1.13	1.17	1.31
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1.33	0.018	1.4	1.32	1.35	1.35	1.33	1.33	1.32	1.30
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	1.53	0.045	3.0	1.60	1.56	1.47	1.48	1.53	1.53	1.54
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	1.39	0.019	1.4	1.39	1.42	1.38	1.38	1.40	1.37	1.36
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	1.19	0.012	1.0	1.19	1.19	1.18	1.16	1.20	1.19	1.20
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1.31	0.028	2.2	1.30	1.33	1.31	1.26	1.33	1.31	1.35
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	1.07	0.045	4.2	1.02	1.08	1.06	1.03	1.09	1.08	1.15
$^{13}C_{12}$-2,3,7,8-TCDD	1.12	0.033	3.0	1.09	1.11	1.10	1.11	1.11	1.13	1.19
$^{13}C_{12}$-1,2,3,7,8-PeCDD	0.78	0.040	5.1	0.75	0.78	0.74	0.78	0.75	0.79	0.86
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	0.87	0.025	2.9	0.86	0.90	0.85	0.83	0.89	0.88	0.89
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1.05	0.015	1.5	1.08	1.06	1.05	1.05	1.04	1.05	1.03
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	0.81	0.016	2.0	0.79	0.81	0.81	0.80	0.80	0.81	0.84
$^{13}C_{12}$-OCDD	0.73	0.046	6.3	0.71	0.72	0.70	0.70	0.73	0.72	0.83
$^{13}C_{12}$-1,2,3,4-TCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$^{37}Cl_4$-2,3,7,8-TCDD	0.97	0.053	5.4	0.90	1.07	0.95	0.94	0.99	0.99	0.99

Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

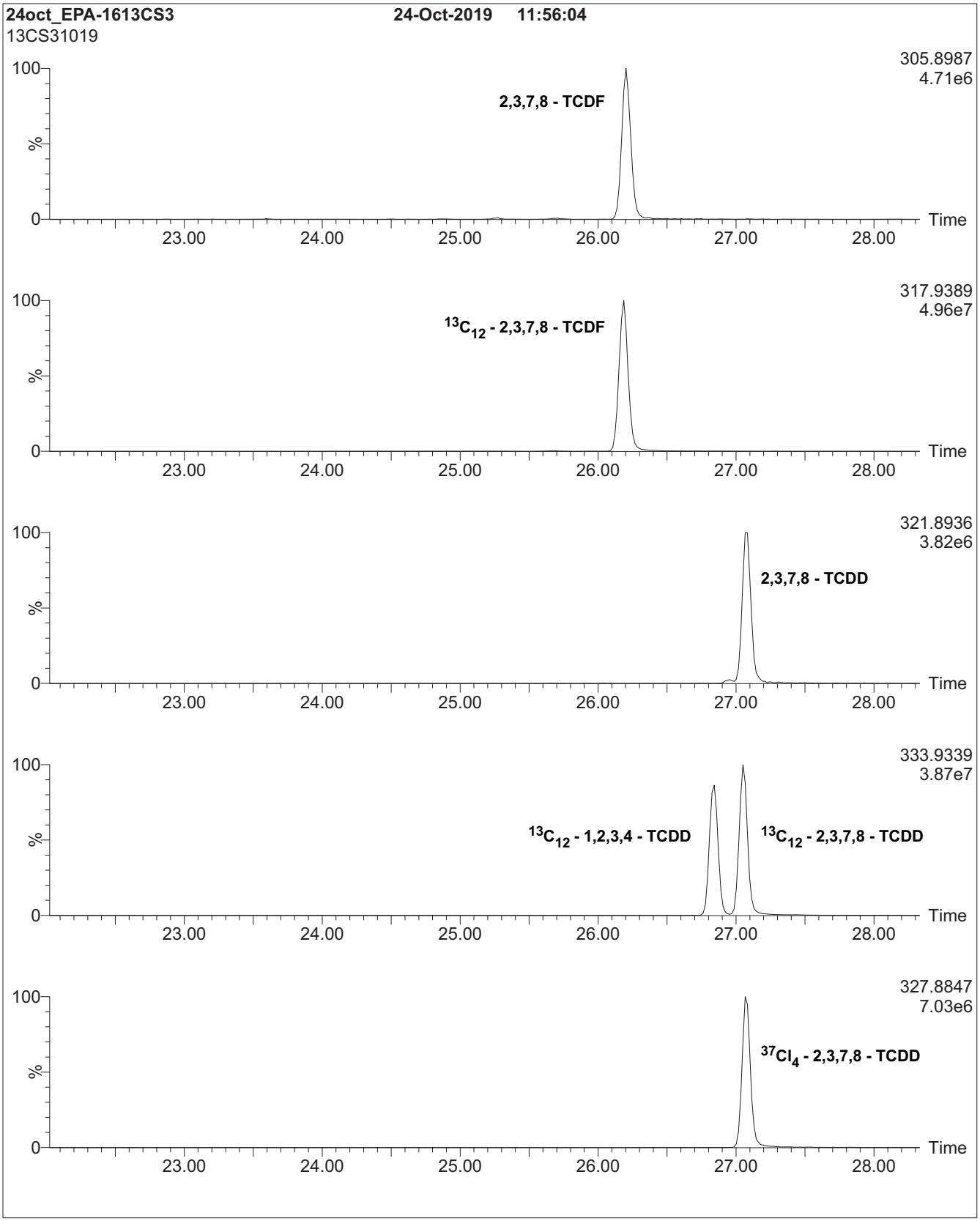


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

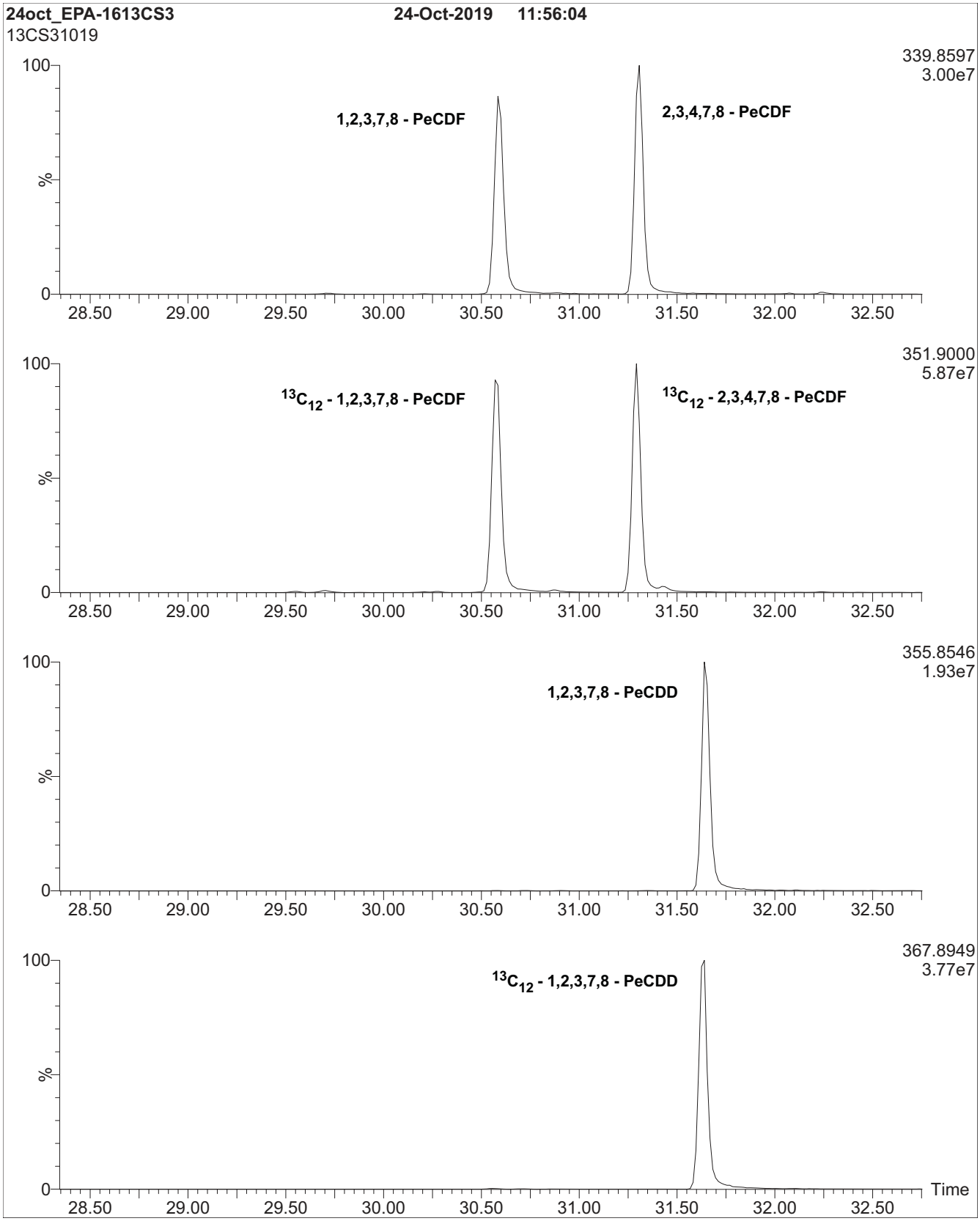


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

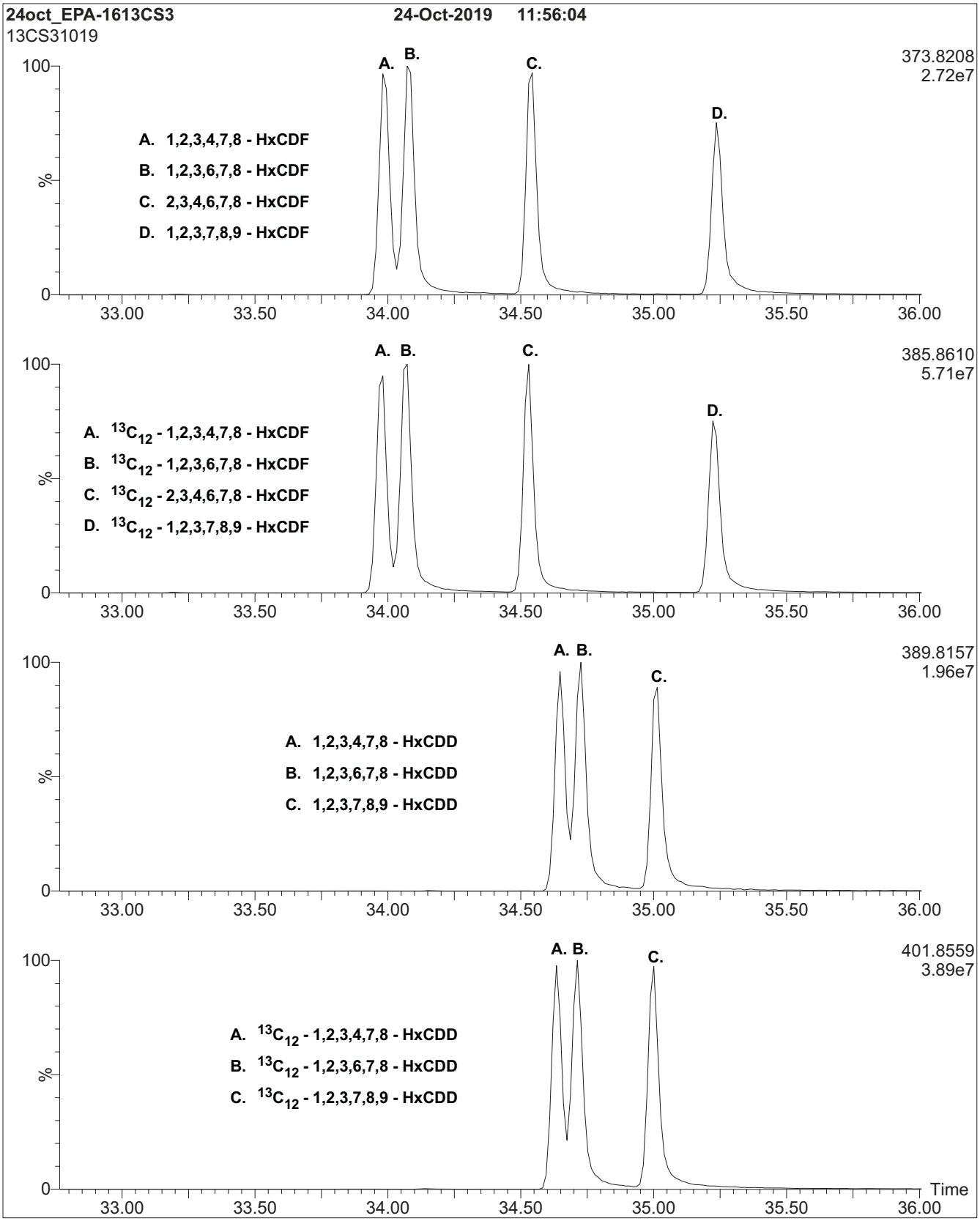


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

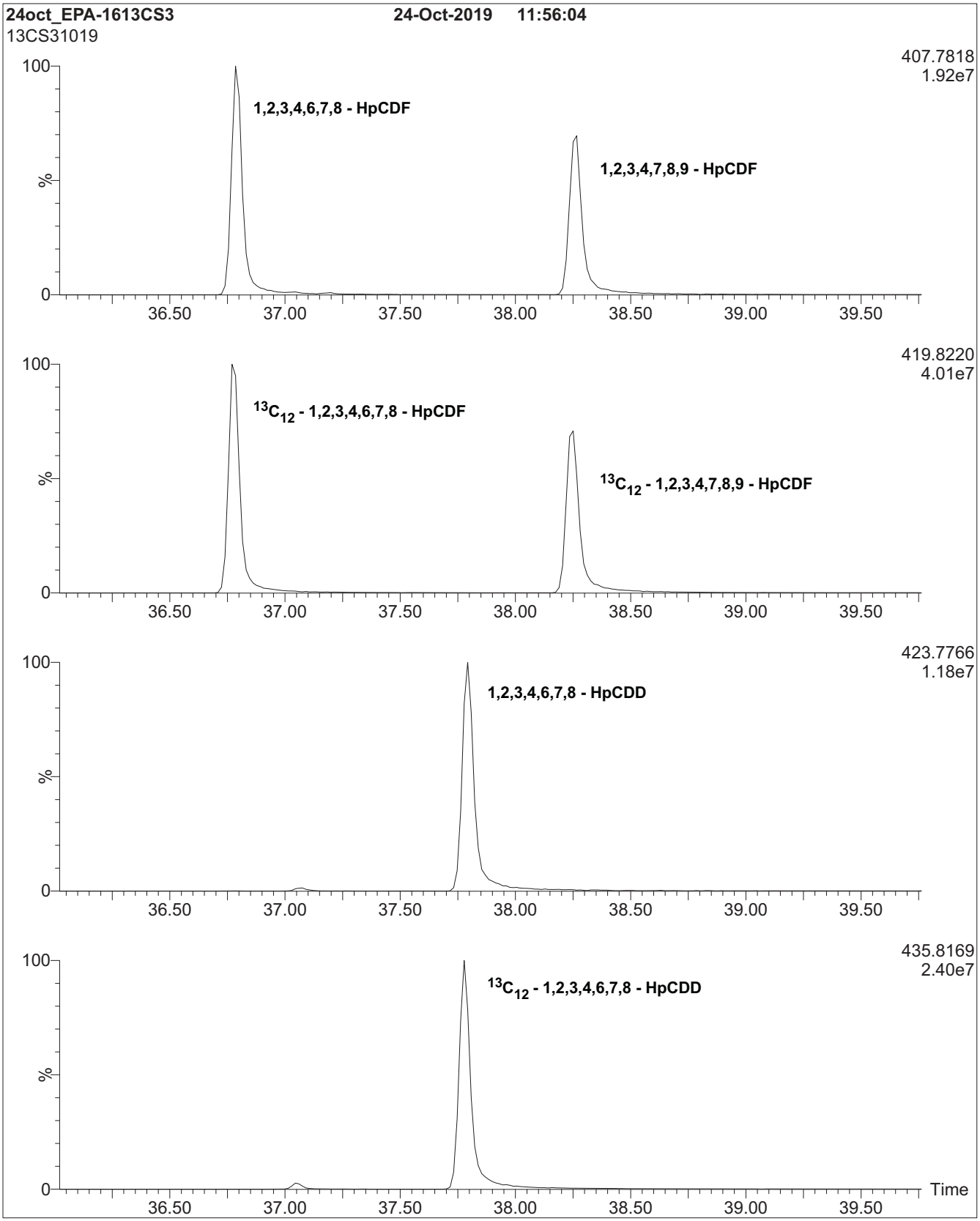
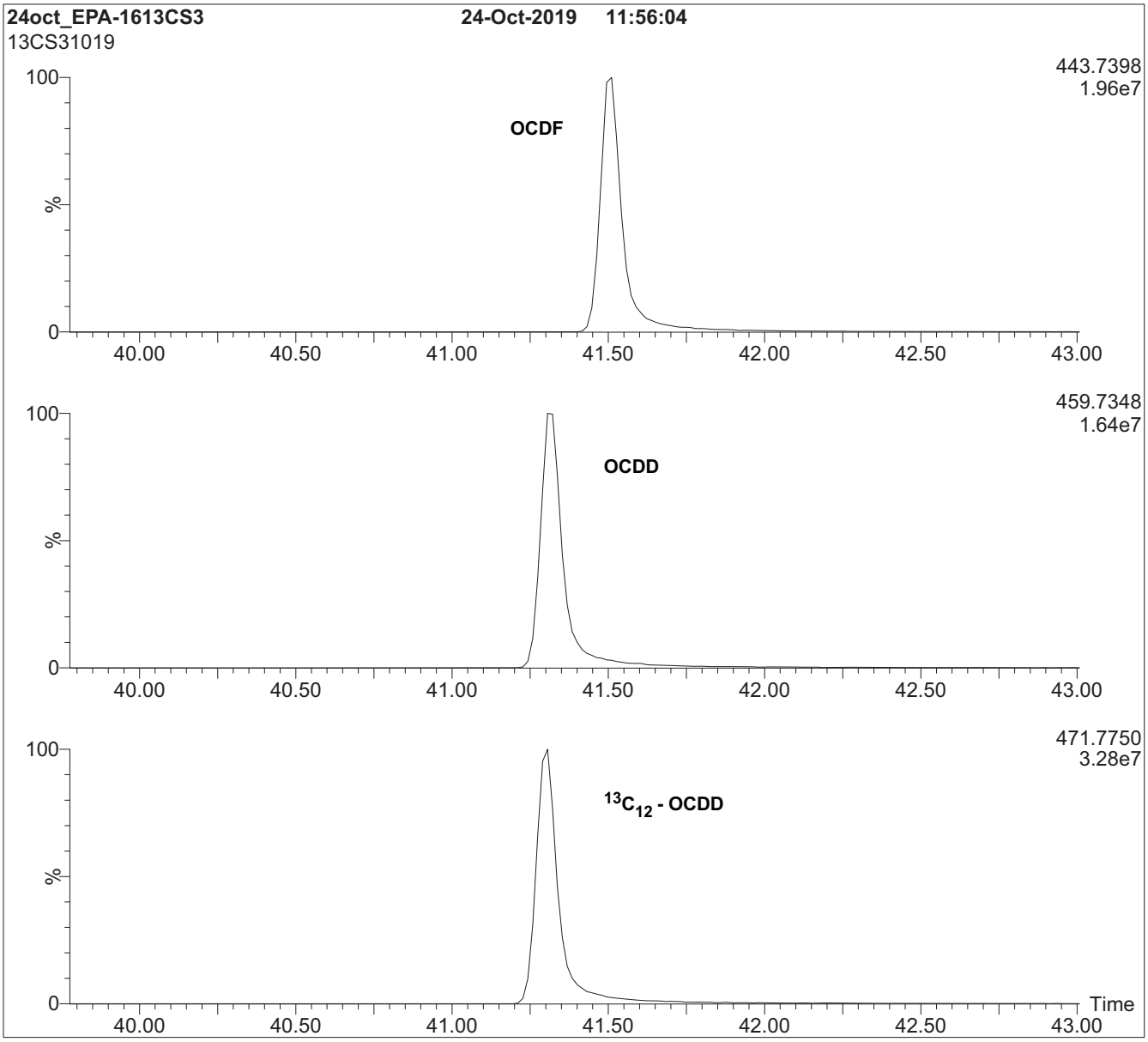


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**



HRGC/HRMS:

Agilent 6890N (HRGC)
Autospec Ultima (HRMS)

Chromatographic Conditions:

Column: 60 m DB-5 (0.25 mm id, 0.25 µm film thickness) Agilent J&W

Flow: Constant at 1 ml/min
Injector: 280 °C (Splitless Injection)
Ionization: EI+
Detector: 280 °C
SIR at 10,000 mass resolving power

Oven: 150 °C (1 min)
12 °C/min to 200 °C
3 °C/min to 235 °C
235 °C (8 min)
8 °C/min to 310 °C
310 °C (8 min)

WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

EPA-1613CVS

U.S. EPA Method 1613 Calibration and Verification Solutions
plus Supplemental Calibration Solutions EPA-1613CSL & EPA-1613CS0.5

PRODUCT CODES:	EPA-1613CVS	**LOT NUMBERS:**	(see below)
	EPA-1613CS1		13CS11019
	EPA-1613CS2		13CS21019
	EPA-1613CS3		13CS31019
	EPA-1613CS4		13CS41019
	EPA-1613CS5		13CS51019

Note: EPA-1613CSL and EPA-1613CS0.5 are lower level extensions to this calibration set that must be ordered separately.

EPA-1613CS0.5	13CS0.51019
EPA-1613CSL	13CSL1019

SOLVENT(S):	Nonane/Toluene
DATE PREPARED: (mm/dd/yyyy)	10/22/2019
LAST TESTED: (mm/dd/yyyy)	10/24/2019
EXPIRY DATE: (mm/dd/yyyy)	10/24/2026
RECOMMENDED STORAGE:	Store ampoules in a cool, dark place

I005458
1613 CS4 CAL STD
Expires 10/24/2026
Prepared By Joshua Rains 6/23/2020

DESCRIPTION:

EPA-1613CVS is a series of 5 calibration solutions containing native ($^{12}C_{12}$) and mass-labelled ($^{13}C_{12}$ and $^{37}Cl_4$) chlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs). The components of each solution, and their concentrations, are given in Table A.

They were designed for, and prepared to be used according to, U.S. EPA Method 1613 (Revision B). They are to be used as received.

EPA-1613CSL and EPA-1613CS0.5 are lower level extensions to EPA-1613CVS. Neither is required by the method, but either or both can be used to extend the calibration to lower levels.

The individual native PCDDs and PCDFs all have chemical purities of >98%. The individual ^{13}C-labelled PCDDs and PCDFs all have chemical purities of >98% and isotopic purities of ≥99%. The 2,3,7,8-$^{37}Cl_4$-Tetrachlorodibenzo-p-dioxin has a chemical purity of >98% and an isotopic (^{37}Cl) purity of ≥95%.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations
Table B: 5-point HRGC/HRMS Calibration and RRF Summary
Table C: 7-point HRGC/HRMS Calibration and RRF Summary
Figure 1: HRGC/HRMS Data for EPA-1613CS3 (SIR; 10,000 mass resolving power)

ADDITIONAL INFORMATION:

- See page 3 for further details.

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a series of standards for the identification and quantification of specific chemical compounds.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned values, and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2,...x_n on which it depends is:

$$u_c(y(x_1, x_2, ...x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analytes is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO 17034 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).

CALA Testing Accreditation No. A 1226

ANAB ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Table A: **EPA-1613CVS (with EPA-1613CSL and EPA-1613CS0.5); Components and Concentrations (ng/ml, ± 5% in nonane/toluene)**

Compound	Concentration (ng/ml)						
Native PCDDs and PCDFs:	**CS1**	**CS2**	**CS3**	**CS4**	**CS5**	**CSL**	**CS0.5**
2,3,7,8-TCDD	0.5	2	10	40	200	0.1	0.25
2,3,7,8-TCDF	0.5	2	10	40	200	0.1	0.25
1,2,3,7,8-PeCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8-PeCDF	2.5	10	50	200	1000	0.5	1.25
2,3,4,7,8-PeCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,6,7,8-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8,9-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,6,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8,9-HxCDF	2.5	10	50	200	1000	0.5	1.25
2,3,4,6,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,6,7,8-HpCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,6,7,8-HpCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8,9-HpCDF	2.5	10	50	200	1000	0.5	1.25
OCDD	5.0	20	100	400	2000	1.0	2.5
OCDF	5.0	20	100	400	2000	1.0	2.5
Labelled PCDDs and PCDFs:							
$^{13}C_{12}$-2,3,7,8-TCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,7,8-TCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8-PeCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8-PeCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,4,7,8-PeCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-OCDD	200	200	200	200	200	200	200
Cleanup Standard:							
$^{37}Cl_4$-2,3,7,8-TCDD	0.5	2	10	40	200	0.1	0.25
Internal Standards:							
$^{13}C_{12}$-1,2,3,4-TCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	100	100	100	100	100	100	100
Percent toluene (v/v)	3.6%	3.7%	4.2%	6.1%	16.2%	3.6%	3.6%

Certified By: _____ **Date:** 10/25/2019
(mm/dd/yyyy)

B.G. Chittim, General Manager

Table B: **EPA-1613CVS; 5-point HRGC/HRMS Calibration and RRF Summary**

Calibration RRF Summary				Calibration Standard				
Calibration Filename: 24oct_EPA1613CVS-CAL.QLD				CS1	CS2	CS3	CS4	CS5
Name	Mean	S. D.	%RSD	RRF#1	RRF#2	RRF#3	RRF#4	RRF#5
2,3,7,8-TCDF	0.93	0.013	1.4	0.92	0.95	0.93	0.92	0.95
1,2,3,7,8-PeCDF	0.93	0.015	1.6	0.92	0.92	0.93	0.93	0.95
2,3,4,7,8-PeCDF	1.04	0.019	1.8	1.03	1.02	1.05	1.05	1.07
1,2,3,4,7,8-HxCDF	0.96	0.035	3.7	0.94	0.92	0.98	0.99	1.00
1,2,3,6,7,8-HxCDF	0.93	0.013	1.4	0.92	0.94	0.94	0.91	0.94
2,3,4,6,7,8-HxCDF	0.96	0.022	2.3	0.95	0.94	0.97	0.97	0.99
1,2,3,7,8,9-HxCDF	0.89	0.021	2.4	0.87	0.88	0.90	0.90	0.92
1,2,3,4,6,7,8-HpCDF	0.91	0.011	1.2	0.90	0.90	0.90	0.92	0.92
1,2,3,4,7,8,9-HpCDF	0.91	0.010	1.1	0.90	0.90	0.92	0.91	0.92
OCDF	1.19	0.056	4.7	1.11	1.17	1.19	1.23	1.26
2,3,7,8-TCDD	1.05	0.023	2.2	1.01	1.06	1.05	1.05	1.07
1,2,3,7,8-PeCDD	0.97	0.018	1.9	0.95	0.95	0.98	0.97	0.99
1,2,3,4,7,8-HxCDD	1.00	0.019	1.9	1.01	1.00	1.00	0.96	1.01
1,2,3,6,7,8-HxCDD	0.98	0.032	3.2	0.93	0.98	0.99	1.01	1.01
1,2,3,7,8,9-HxCDD	0.97	0.016	1.6	0.95	0.96	0.98	0.99	0.98
1,2,3,4,6,7,8-HpCDD	1.01	0.025	2.5	1.01	0.97	1.02	1.03	1.04
OCDD	1.00	0.013	1.3	1.00	0.99	1.02	1.02	1.00
$^{13}C_{12}$-2,3,7,8-TCDF	1.57	0.047	3.0	1.52	1.55	1.55	1.57	1.65
$^{13}C_{12}$-1,2,3,7,8-PeCDF	1.21	0.078	6.5	1.13	1.20	1.17	1.20	1.34
$^{13}C_{12}$-2,3,4,7,8-PeCDF	1.17	0.081	6.9	1.09	1.15	1.13	1.17	1.31
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1.33	0.020	1.5	1.35	1.33	1.33	1.32	1.30
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	1.51	0.034	2.2	1.47	1.48	1.53	1.53	1.54
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	1.38	0.012	0.9	1.38	1.38	1.40	1.37	1.36
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	1.19	0.014	1.2	1.18	1.16	1.20	1.19	1.20
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1.31	0.033	2.5	1.31	1.26	1.33	1.31	1.35
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	1.08	0.046	4.3	1.06	1.03	1.09	1.08	1.15
$^{13}C_{12}$-2,3,7,8-TCDD	1.13	0.036	3.2	1.10	1.11	1.11	1.13	1.19
$^{13}C_{12}$-1,2,3,7,8-PeCDD	0.79	0.047	5.9	0.74	0.78	0.75	0.79	0.86
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	0.87	0.027	3.1	0.85	0.83	0.89	0.88	0.89
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1.04	0.010	1.0	1.05	1.05	1.04	1.05	1.03
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	0.81	0.017	2.1	0.81	0.80	0.80	0.81	0.84
$^{13}C_{12}$-OCDD	0.74	0.055	7.4	0.70	0.70	0.73	0.72	0.83
$^{13}C_{12}$-1,2,3,4-TCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00
$^{37}Cl_4$-2,3,7,8-TCDD	0.97	0.026	2.6	0.95	0.94	0.99	0.99	0.99

Table C: **EPA-1613CVS (with EPA-1613CSL and EPA-1613CS0.5); 7-point HRGC/HRMS Calibration and RRF Summary**

Calibration RRF Summary				Calibration Standard						
Calibration Filename: 24oct_EPA1613CVS-CAL.QLD				CSL	CS0.5	CS1	CS2	CS3	CS4	CS5
Name	Mean	S. D.	%RSD	RRF#1	RRF#2	RRF#3	RRF#4	RRF#5	RRF#6	RRF#7
2,3,7,8-TCDF	0.92	0.045	4.8	0.96	0.83	0.92	0.95	0.93	0.92	0.95
1,2,3,7,8-PeCDF	0.93	0.013	1.4	0.94	0.92	0.92	0.92	0.93	0.93	0.95
2,3,4,7,8-PeCDF	1.02	0.058	5.7	0.90	1.00	1.03	1.02	1.05	1.05	1.07
1,2,3,4,7,8-HxCDF	0.96	0.029	3.0	0.96	0.97	0.94	0.92	0.98	0.99	1.00
1,2,3,6,7,8-HxCDF	0.92	0.030	3.3	0.90	0.86	0.92	0.94	0.94	0.91	0.94
2,3,4,6,7,8-HxCDF	0.94	0.047	5.0	0.87	0.89	0.95	0.94	0.97	0.97	0.99
1,2,3,7,8,9-HxCDF	0.88	0.029	3.3	0.83	0.88	0.87	0.88	0.90	0.90	0.92
1,2,3,4,6,7,8-HpCDF	0.90	0.033	3.7	0.83	0.93	0.90	0.90	0.90	0.92	0.92
1,2,3,4,7,8,9-HpCDF	0.91	0.018	1.9	0.89	0.94	0.90	0.90	0.92	0.91	0.92
OCDF	1.18	0.052	4.4	1.15	1.14	1.11	1.17	1.19	1.23	1.26
2,3,7,8-TCDD	1.03	0.051	5.0	1.03	0.92	1.01	1.06	1.05	1.05	1.07
1,2,3,7,8-PeCDD	0.95	0.042	4.4	0.87	0.98	0.95	0.95	0.98	0.97	0.99
1,2,3,4,7,8-HxCDD	0.97	0.066	6.8	0.83	0.98	1.01	1.00	1.00	0.96	1.01
1,2,3,6,7,8-HxCDD	0.96	0.044	4.5	0.90	0.92	0.93	0.98	0.99	1.01	1.01
1,2,3,7,8,9-HxCDD	0.94	0.054	5.7	0.83	0.92	0.95	0.96	0.98	0.99	0.98
1,2,3,4,6,7,8-HpCDD	1.01	0.033	3.3	0.95	1.03	1.01	0.97	1.02	1.03	1.04
OCDD	1.00	0.023	2.3	0.95	1.00	1.00	0.99	1.02	1.02	1.00
$^{13}C_{12}$-2,3,7,8-TCDF	1.56	0.042	2.7	1.52	1.54	1.52	1.55	1.55	1.57	1.65
$^{13}C_{12}$-1,2,3,7,8-PeCDF	1.20	0.066	5.5	1.18	1.17	1.13	1.20	1.17	1.20	1.34
$^{13}C_{12}$-2,3,4,7,8-PeCDF	1.16	0.071	6.1	1.12	1.13	1.09	1.15	1.13	1.17	1.31
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1.33	0.018	1.4	1.32	1.35	1.35	1.33	1.33	1.32	1.30
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	1.53	0.045	3.0	1.60	1.56	1.47	1.48	1.53	1.53	1.54
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	1.39	0.019	1.4	1.39	1.42	1.38	1.38	1.40	1.37	1.36
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	1.19	0.012	1.0	1.19	1.19	1.18	1.16	1.20	1.19	1.20
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1.31	0.028	2.2	1.30	1.33	1.31	1.26	1.33	1.31	1.35
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	1.07	0.045	4.2	1.02	1.08	1.06	1.03	1.09	1.08	1.15
$^{13}C_{12}$-2,3,7,8-TCDD	1.12	0.033	3.0	1.09	1.11	1.10	1.11	1.11	1.13	1.19
$^{13}C_{12}$-1,2,3,7,8-PeCDD	0.78	0.040	5.1	0.75	0.78	0.74	0.78	0.75	0.79	0.86
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	0.87	0.025	2.9	0.86	0.90	0.85	0.83	0.89	0.88	0.89
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1.05	0.015	1.5	1.08	1.06	1.05	1.05	1.04	1.05	1.03
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	0.81	0.016	2.0	0.79	0.81	0.81	0.80	0.80	0.81	0.84
$^{13}C_{12}$-OCDD	0.73	0.046	6.3	0.71	0.72	0.70	0.70	0.73	0.72	0.83
$^{13}C_{12}$-1,2,3,4-TCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$^{37}Cl_4$-2,3,7,8-TCDD	0.97	0.053	5.4	0.90	1.07	0.95	0.94	0.99	0.99	0.99

Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

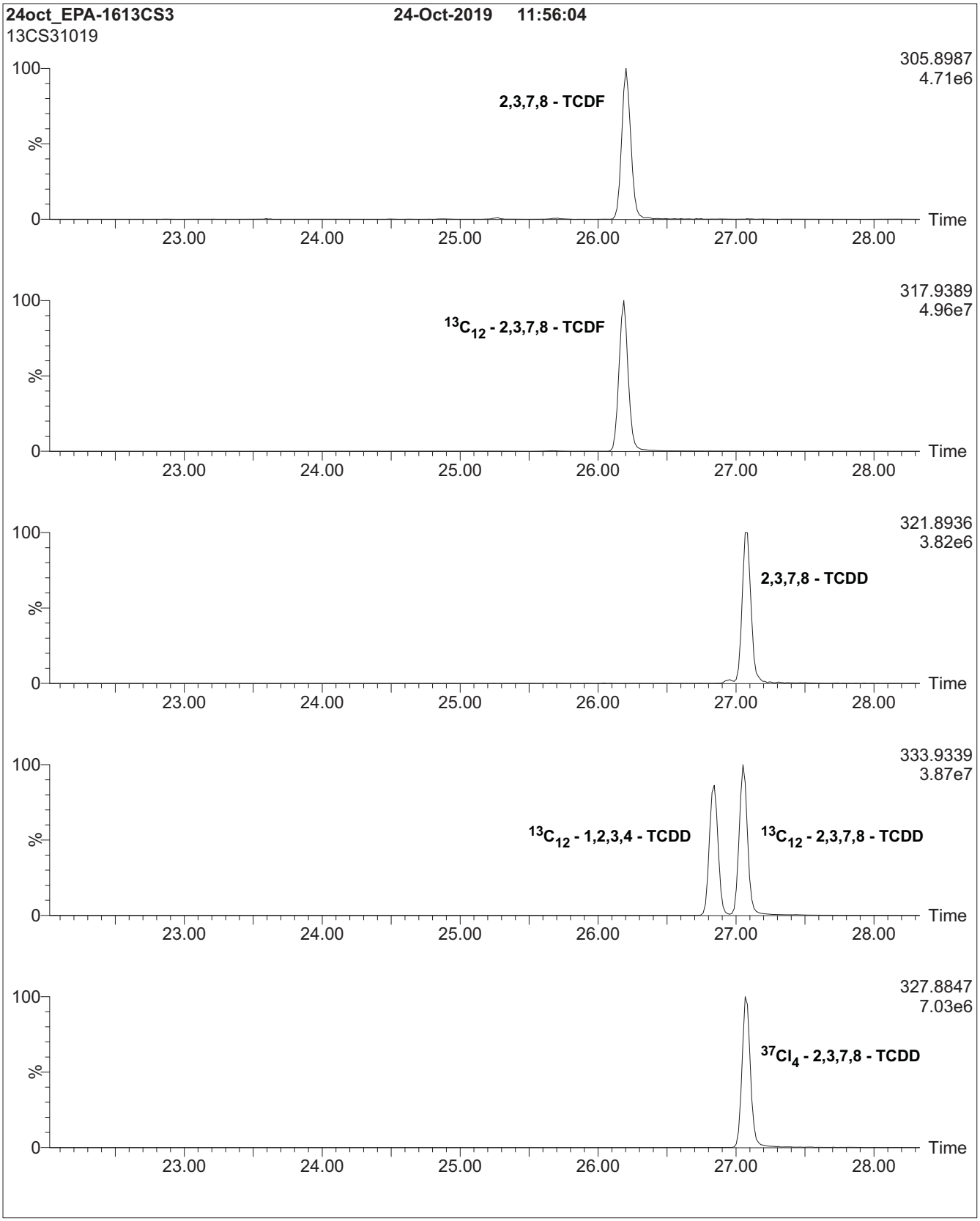


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

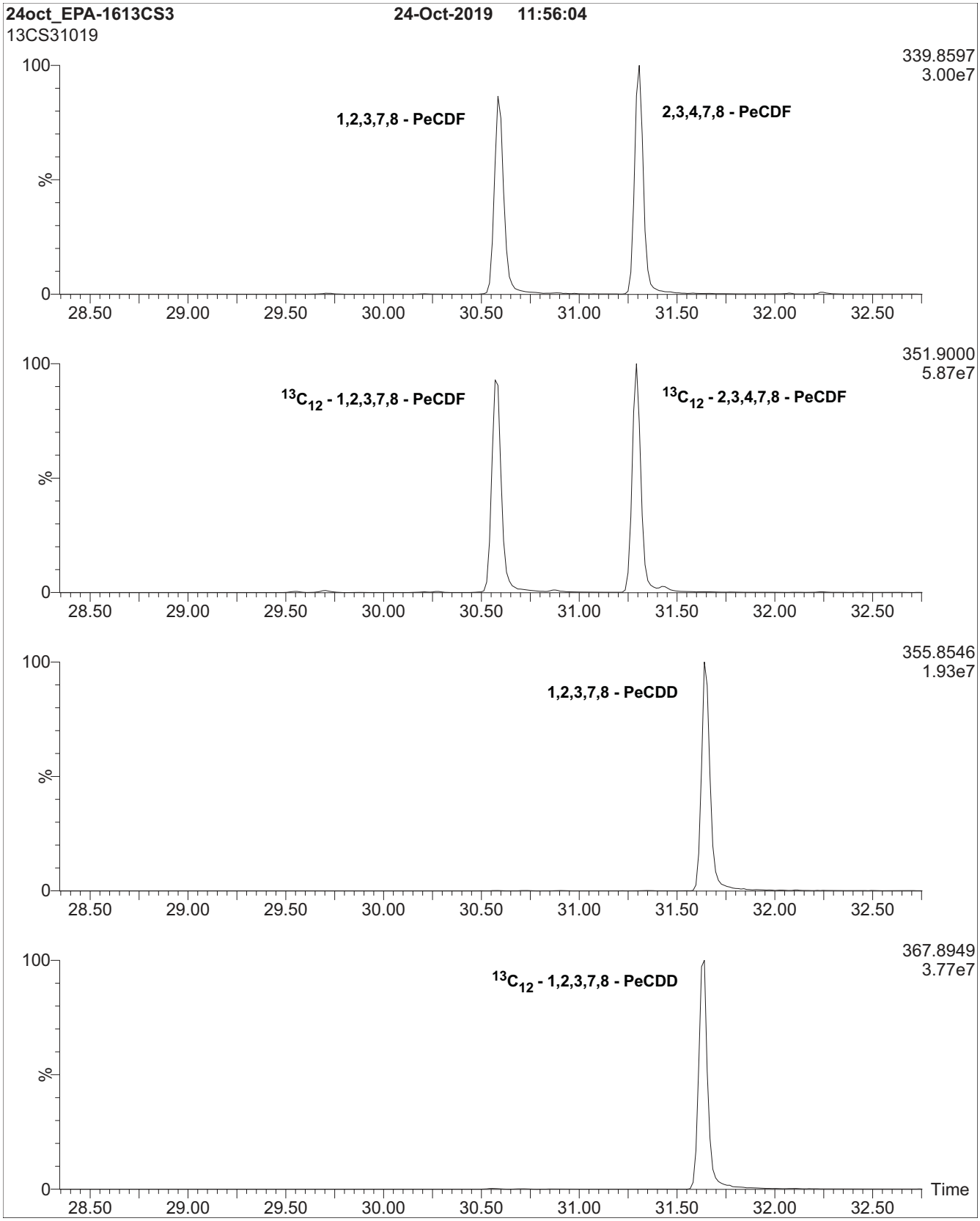


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

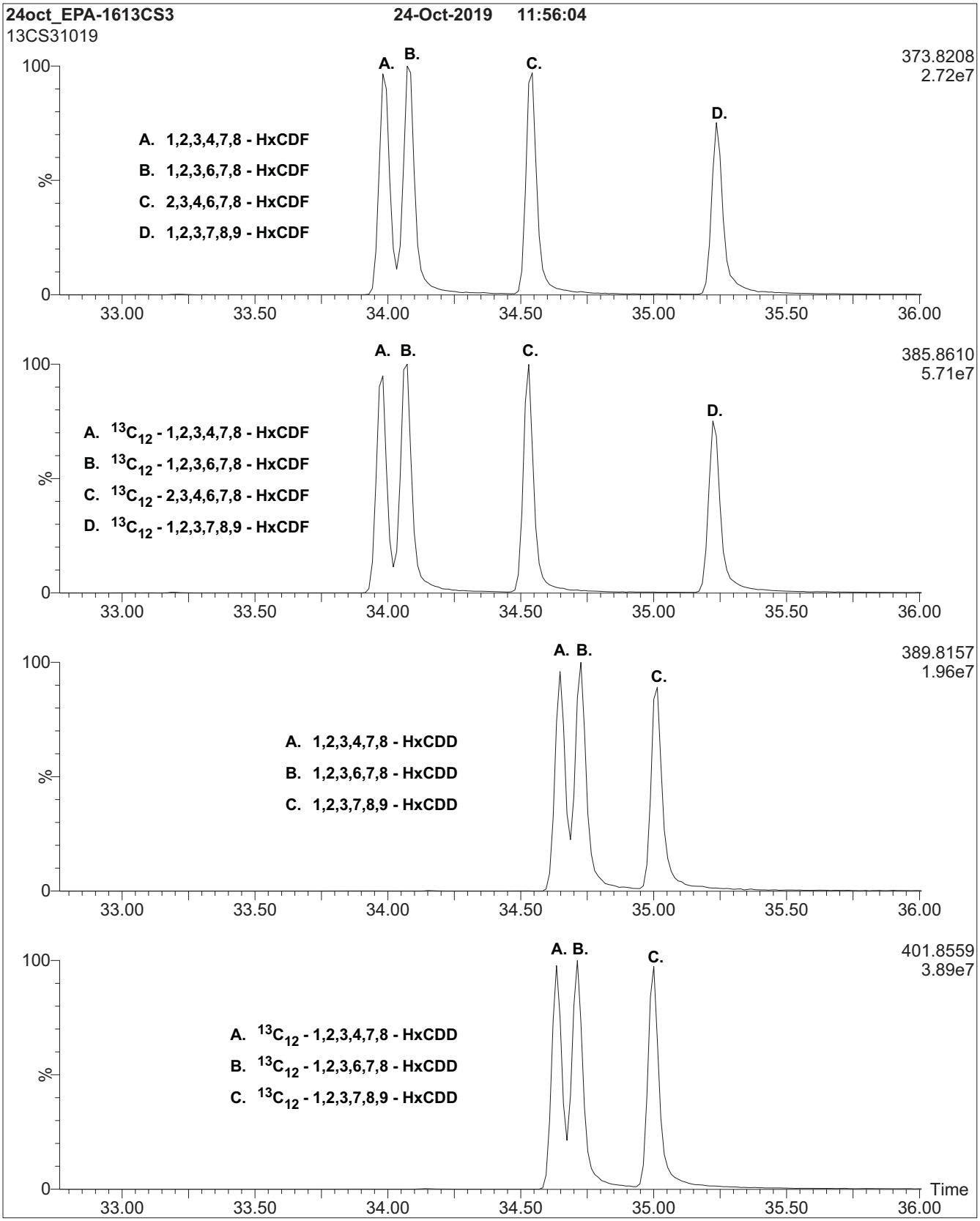


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

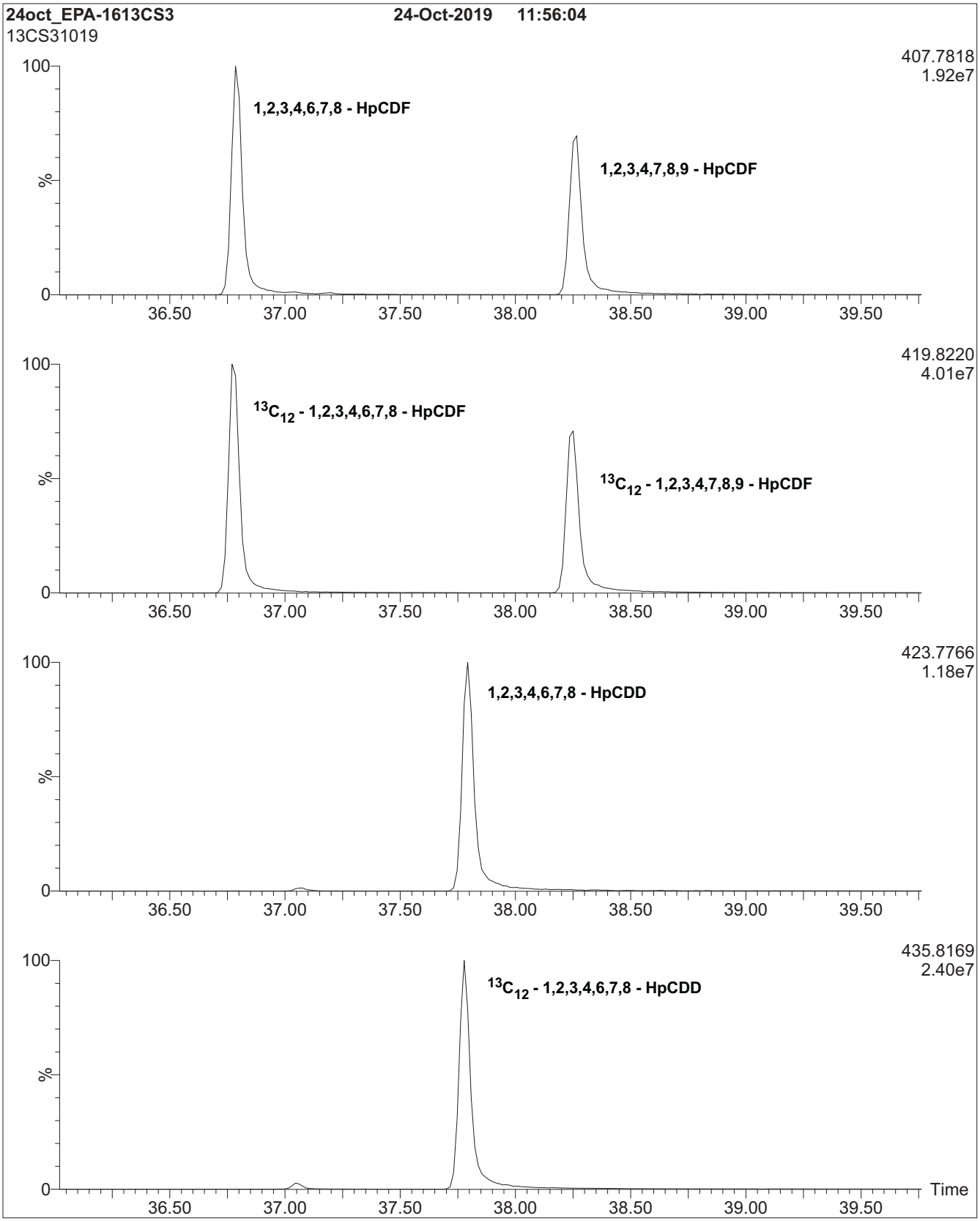
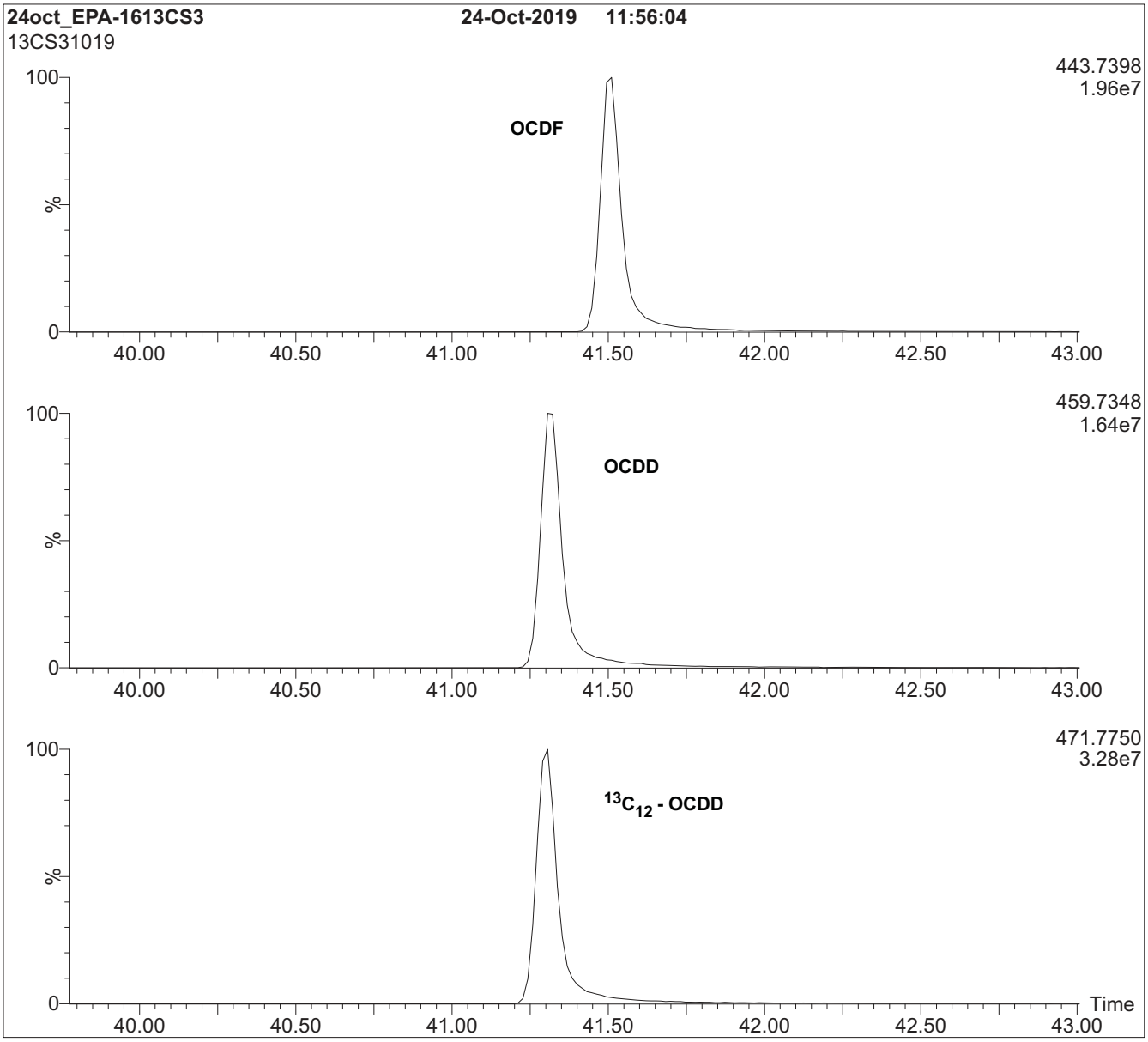


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**



HRGC/HRMS:

Agilent 6890N (HRGC)
Autospec Ultima (HRMS)

Chromatographic Conditions:

Column: 60 m DB-5 (0.25 mm id, 0.25 µm film thickness) Agilent J&W

Flow: Constant at 1 ml/min
Injector: 280 °C (Splitless Injection)
Ionization: EI+
Detector: 280 °C
SIR at 10,000 mass resolving power

Oven: 150 °C (1 min)
12 °C/min to 200 °C
3 °C/min to 235 °C
235 °C (8 min)
8 °C/min to 310 °C
310 °C (8 min)

WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

EPA-1613CVS

U.S. EPA Method 1613 Calibration and Verification Solutions
plus Supplemental Calibration Solutions EPA-1613CSL & EPA-1613CS0.5

PRODUCT CODES:	EPA-1613CVS	**LOT NUMBERS:**	(see below)
	EPA-1613CS1		13CS11019
	EPA-1613CS2		13CS21019
	EPA-1613CS3		13CS31019
	EPA-1613CS4		13CS41019
	EPA-1613CS5		13CS51019

Note: EPA-1613CSL and EPA-1613CS0.5 are lower level extensions to this calibration set that must be ordered separately.

EPA-1613CS0.5	13CS0.51019
EPA-1613CSL	13CSL1019

SOLVENT(S):	Nonane/Toluene
DATE PREPARED: (mm/dd/yyyy)	10/22/2019
LAST TESTED: (mm/dd/yyyy)	10/24/2019
EXPIRY DATE: (mm/dd/yyyy)	10/24/2026
RECOMMENDED STORAGE:	Store ampoules in a cool, dark place

I005459
1613 CS5 CAL STD
Expires 10/24/2026
Prepared By Joshua Rains 6/23/2020

DESCRIPTION:

EPA-1613CVS is a series of 5 calibration solutions containing native ($^{12}C_{12}$) and mass-labelled ($^{13}C_{12}$ and $^{37}Cl_4$) chlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs). The components of each solution, and their concentrations, are given in Table A.

They were designed for, and prepared to be used according to, U.S. EPA Method 1613 (Revision B). They are to be used as received.

EPA-1613CSL and EPA-1613CS0.5 are lower level extensions to EPA-1613CVS. Neither is required by the method, but either or both can be used to extend the calibration to lower levels.

The individual native PCDDs and PCDFs all have chemical purities of >98%. The individual ^{13}C-labelled PCDDs and PCDFs all have chemical purities of >98% and isotopic purities of ≥99%. The 2,3,7,8-$^{37}Cl_4$-Tetrachlorodibenzo-p-dioxin has a chemical purity of >98% and an isotopic (^{37}Cl) purity of ≥95%.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations
Table B: 5-point HRGC/HRMS Calibration and RRF Summary
Table C: 7-point HRGC/HRMS Calibration and RRF Summary
Figure 1: HRGC/HRMS Data for EPA-1613CS3 (SIR; 10,000 mass resolving power)

ADDITIONAL INFORMATION:

- See page 3 for further details.

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a series of standards for the identification and quantification of specific chemical compounds.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned values, and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2,...x_n on which it depends is:

$$u_c(y(x_1, x_2, ...x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analytes is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO 17034 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).

CALA Testing Accreditation No. A 1226

ANAB ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Table A: **EPA-1613CVS (with EPA-1613CSL and EPA-1613CS0.5); Components and Concentrations (ng/ml, ± 5% in nonane/toluene)**

Compound	Concentration (ng/ml)						
Native PCDDs and PCDFs:	**CS1**	**CS2**	**CS3**	**CS4**	**CS5**	**CSL**	**CS0.5**
2,3,7,8-TCDD	0.5	2	10	40	200	0.1	0.25
2,3,7,8-TCDF	0.5	2	10	40	200	0.1	0.25
1,2,3,7,8-PeCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8-PeCDF	2.5	10	50	200	1000	0.5	1.25
2,3,4,7,8-PeCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,6,7,8-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8,9-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,6,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8,9-HxCDF	2.5	10	50	200	1000	0.5	1.25
2,3,4,6,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,6,7,8-HpCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,6,7,8-HpCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8,9-HpCDF	2.5	10	50	200	1000	0.5	1.25
OCDD	5.0	20	100	400	2000	1.0	2.5
OCDF	5.0	20	100	400	2000	1.0	2.5
Labelled PCDDs and PCDFs:							
$^{13}C_{12}$-2,3,7,8-TCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,7,8-TCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8-PeCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8-PeCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,4,7,8-PeCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-OCDD	200	200	200	200	200	200	200
Cleanup Standard:							
$^{37}Cl_4$-2,3,7,8-TCDD	0.5	2	10	40	200	0.1	0.25
Internal Standards:							
$^{13}C_{12}$-1,2,3,4-TCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	100	100	100	100	100	100	100
Percent toluene (v/v)	3.6%	3.7%	4.2%	6.1%	16.2%	3.6%	3.6%

Certified By: _____ **Date:** 10/25/2019
(mm/dd/yyyy)

B.G. Chittim, General Manager

Table B: **EPA-1613CVS; 5-point HRGC/HRMS Calibration and RRF Summary**

Calibration RRF Summary				Calibration Standard				
Calibration Filename: 24oct_EPA1613CVS-CAL.QLD				CS1	CS2	CS3	CS4	CS5
Name	Mean	S. D.	%RSD	RRF#1	RRF#2	RRF#3	RRF#4	RRF#5
2,3,7,8-TCDF	0.93	0.013	1.4	0.92	0.95	0.93	0.92	0.95
1,2,3,7,8-PeCDF	0.93	0.015	1.6	0.92	0.92	0.93	0.93	0.95
2,3,4,7,8-PeCDF	1.04	0.019	1.8	1.03	1.02	1.05	1.05	1.07
1,2,3,4,7,8-HxCDF	0.96	0.035	3.7	0.94	0.92	0.98	0.99	1.00
1,2,3,6,7,8-HxCDF	0.93	0.013	1.4	0.92	0.94	0.94	0.91	0.94
2,3,4,6,7,8-HxCDF	0.96	0.022	2.3	0.95	0.94	0.97	0.97	0.99
1,2,3,7,8,9-HxCDF	0.89	0.021	2.4	0.87	0.88	0.90	0.90	0.92
1,2,3,4,6,7,8-HpCDF	0.91	0.011	1.2	0.90	0.90	0.90	0.92	0.92
1,2,3,4,7,8,9-HpCDF	0.91	0.010	1.1	0.90	0.90	0.92	0.91	0.92
OCDF	1.19	0.056	4.7	1.11	1.17	1.19	1.23	1.26
2,3,7,8-TCDD	1.05	0.023	2.2	1.01	1.06	1.05	1.05	1.07
1,2,3,7,8-PeCDD	0.97	0.018	1.9	0.95	0.95	0.98	0.97	0.99
1,2,3,4,7,8-HxCDD	1.00	0.019	1.9	1.01	1.00	1.00	0.96	1.01
1,2,3,6,7,8-HxCDD	0.98	0.032	3.2	0.93	0.98	0.99	1.01	1.01
1,2,3,7,8,9-HxCDD	0.97	0.016	1.6	0.95	0.96	0.98	0.99	0.98
1,2,3,4,6,7,8-HpCDD	1.01	0.025	2.5	1.01	0.97	1.02	1.03	1.04
OCDD	1.00	0.013	1.3	1.00	0.99	1.02	1.02	1.00
$^{13}C_{12}$-2,3,7,8-TCDF	1.57	0.047	3.0	1.52	1.55	1.55	1.57	1.65
$^{13}C_{12}$-1,2,3,7,8-PeCDF	1.21	0.078	6.5	1.13	1.20	1.17	1.20	1.34
$^{13}C_{12}$-2,3,4,7,8-PeCDF	1.17	0.081	6.9	1.09	1.15	1.13	1.17	1.31
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1.33	0.020	1.5	1.35	1.33	1.33	1.32	1.30
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	1.51	0.034	2.2	1.47	1.48	1.53	1.53	1.54
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	1.38	0.012	0.9	1.38	1.38	1.40	1.37	1.36
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	1.19	0.014	1.2	1.18	1.16	1.20	1.19	1.20
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1.31	0.033	2.5	1.31	1.26	1.33	1.31	1.35
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	1.08	0.046	4.3	1.06	1.03	1.09	1.08	1.15
$^{13}C_{12}$-2,3,7,8-TCDD	1.13	0.036	3.2	1.10	1.11	1.11	1.13	1.19
$^{13}C_{12}$-1,2,3,7,8-PeCDD	0.79	0.047	5.9	0.74	0.78	0.75	0.79	0.86
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	0.87	0.027	3.1	0.85	0.83	0.89	0.88	0.89
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1.04	0.010	1.0	1.05	1.05	1.04	1.05	1.03
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	0.81	0.017	2.1	0.81	0.80	0.80	0.81	0.84
$^{13}C_{12}$-OCDD	0.74	0.055	7.4	0.70	0.70	0.73	0.72	0.83
$^{13}C_{12}$-1,2,3,4-TCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00
$^{37}Cl_4$-2,3,7,8-TCDD	0.97	0.026	2.6	0.95	0.94	0.99	0.99	0.99

Table C: **EPA-1613CVS (with EPA-1613CSL and EPA-1613CS0.5); 7-point HRGC/HRMS Calibration and RRF Summary**

Calibration RRF Summary				Calibration Standard						
Calibration Filename: 24oct_EPA1613CVS-CAL.QLD				CSL	CS0.5	CS1	CS2	CS3	CS4	CS5
Name	Mean	S. D.	%RSD	RRF#1	RRF#2	RRF#3	RRF#4	RRF#5	RRF#6	RRF#7
2,3,7,8-TCDF	0.92	0.045	4.8	0.96	0.83	0.92	0.95	0.93	0.92	0.95
1,2,3,7,8-PeCDF	0.93	0.013	1.4	0.94	0.92	0.92	0.92	0.93	0.93	0.95
2,3,4,7,8-PeCDF	1.02	0.058	5.7	0.90	1.00	1.03	1.02	1.05	1.05	1.07
1,2,3,4,7,8-HxCDF	0.96	0.029	3.0	0.96	0.97	0.94	0.92	0.98	0.99	1.00
1,2,3,6,7,8-HxCDF	0.92	0.030	3.3	0.90	0.86	0.92	0.94	0.94	0.91	0.94
2,3,4,6,7,8-HxCDF	0.94	0.047	5.0	0.87	0.89	0.95	0.94	0.97	0.97	0.99
1,2,3,7,8,9-HxCDF	0.88	0.029	3.3	0.83	0.88	0.87	0.88	0.90	0.90	0.92
1,2,3,4,6,7,8-HpCDF	0.90	0.033	3.7	0.83	0.93	0.90	0.90	0.90	0.92	0.92
1,2,3,4,7,8,9-HpCDF	0.91	0.018	1.9	0.89	0.94	0.90	0.90	0.92	0.91	0.92
OCDF	1.18	0.052	4.4	1.15	1.14	1.11	1.17	1.19	1.23	1.26
2,3,7,8-TCDD	1.03	0.051	5.0	1.03	0.92	1.01	1.06	1.05	1.05	1.07
1,2,3,7,8-PeCDD	0.95	0.042	4.4	0.87	0.98	0.95	0.95	0.98	0.97	0.99
1,2,3,4,7,8-HxCDD	0.97	0.066	6.8	0.83	0.98	1.01	1.00	1.00	0.96	1.01
1,2,3,6,7,8-HxCDD	0.96	0.044	4.5	0.90	0.92	0.93	0.98	0.99	1.01	1.01
1,2,3,7,8,9-HxCDD	0.94	0.054	5.7	0.83	0.92	0.95	0.96	0.98	0.99	0.98
1,2,3,4,6,7,8-HpCDD	1.01	0.033	3.3	0.95	1.03	1.01	0.97	1.02	1.03	1.04
OCDD	1.00	0.023	2.3	0.95	1.00	1.00	0.99	1.02	1.02	1.00
$^{13}C_{12}$-2,3,7,8-TCDF	1.56	0.042	2.7	1.52	1.54	1.52	1.55	1.55	1.57	1.65
$^{13}C_{12}$-1,2,3,7,8-PeCDF	1.20	0.066	5.5	1.18	1.17	1.13	1.20	1.17	1.20	1.34
$^{13}C_{12}$-2,3,4,7,8-PeCDF	1.16	0.071	6.1	1.12	1.13	1.09	1.15	1.13	1.17	1.31
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1.33	0.018	1.4	1.32	1.35	1.35	1.33	1.33	1.32	1.30
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	1.53	0.045	3.0	1.60	1.56	1.47	1.48	1.53	1.53	1.54
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	1.39	0.019	1.4	1.39	1.42	1.38	1.38	1.40	1.37	1.36
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	1.19	0.012	1.0	1.19	1.19	1.18	1.16	1.20	1.19	1.20
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1.31	0.028	2.2	1.30	1.33	1.31	1.26	1.33	1.31	1.35
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	1.07	0.045	4.2	1.02	1.08	1.06	1.03	1.09	1.08	1.15
$^{13}C_{12}$-2,3,7,8-TCDD	1.12	0.033	3.0	1.09	1.11	1.10	1.11	1.11	1.13	1.19
$^{13}C_{12}$-1,2,3,7,8-PeCDD	0.78	0.040	5.1	0.75	0.78	0.74	0.78	0.75	0.79	0.86
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	0.87	0.025	2.9	0.86	0.90	0.85	0.83	0.89	0.88	0.89
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1.05	0.015	1.5	1.08	1.06	1.05	1.05	1.04	1.05	1.03
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	0.81	0.016	2.0	0.79	0.81	0.81	0.80	0.80	0.81	0.84
$^{13}C_{12}$-OCDD	0.73	0.046	6.3	0.71	0.72	0.70	0.70	0.73	0.72	0.83
$^{13}C_{12}$-1,2,3,4-TCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$^{37}Cl_4$-2,3,7,8-TCDD	0.97	0.053	5.4	0.90	1.07	0.95	0.94	0.99	0.99	0.99

Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

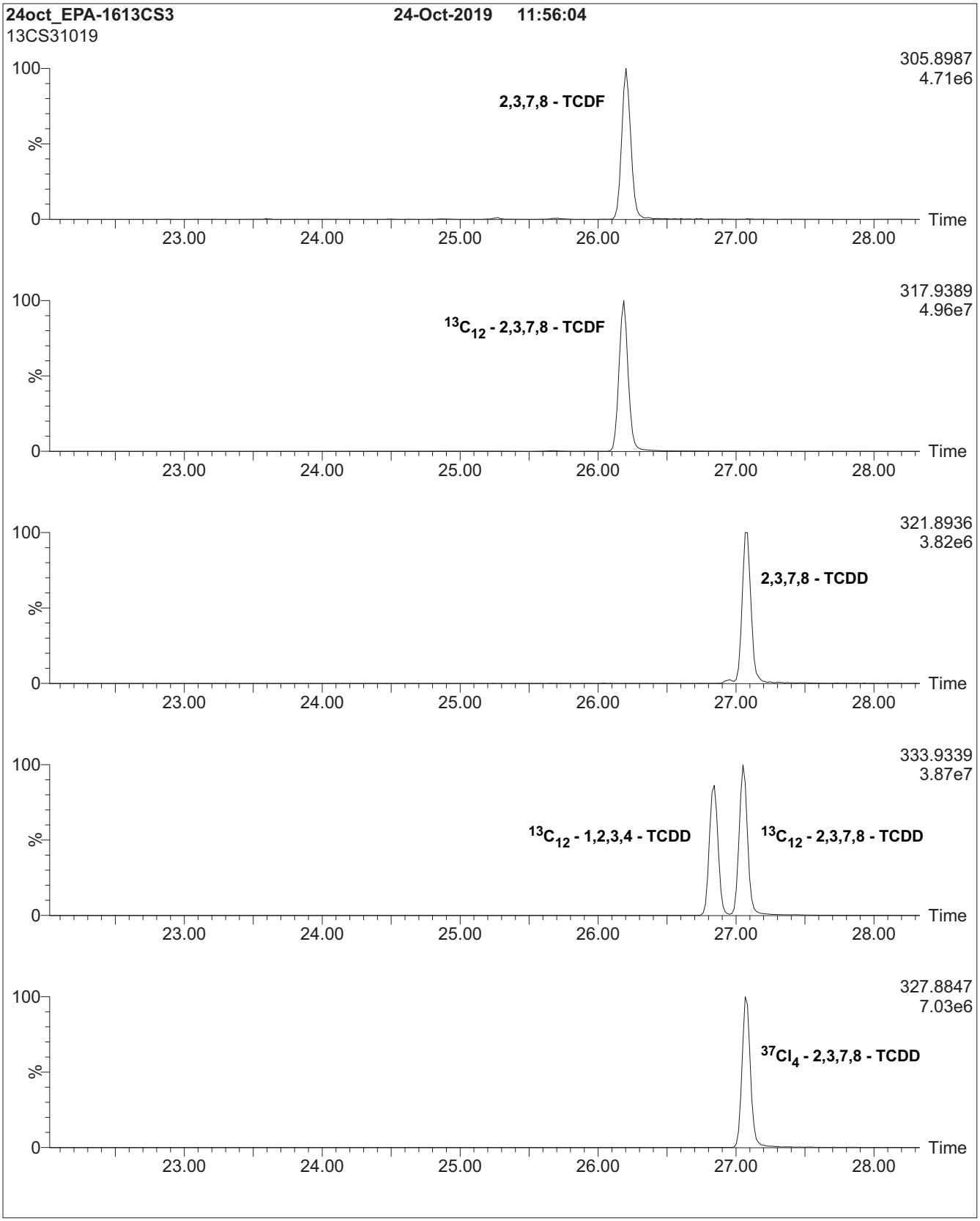
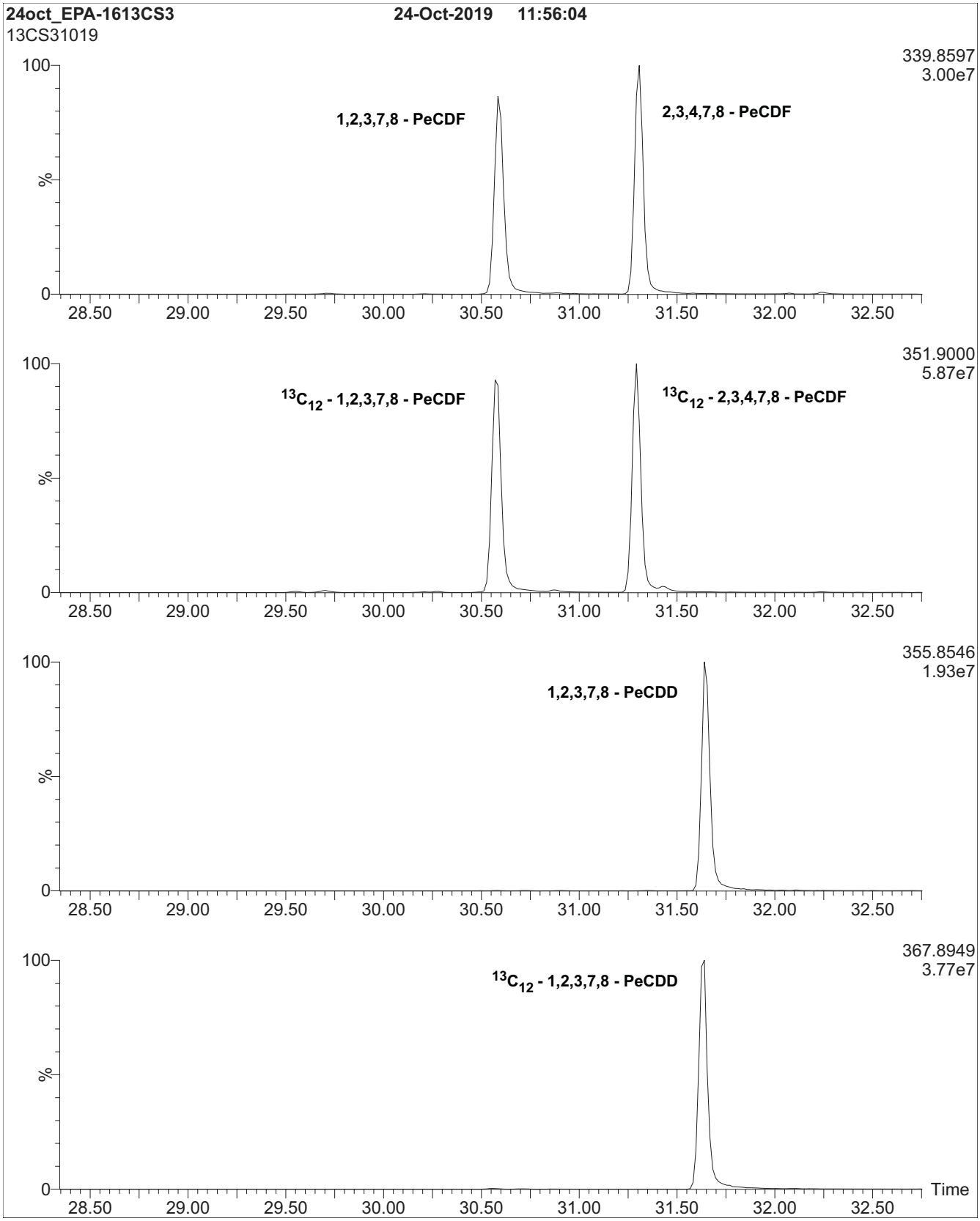


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**



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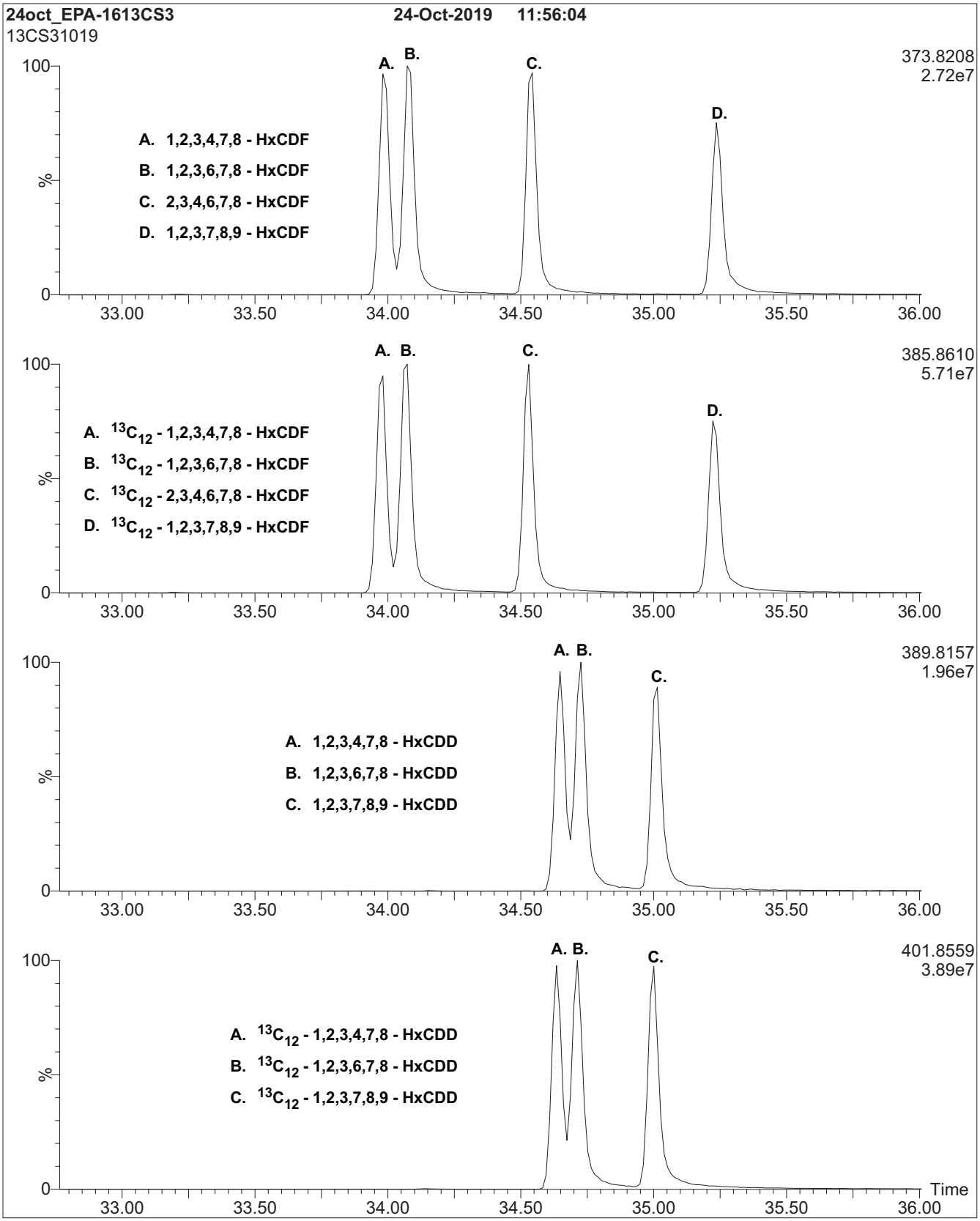

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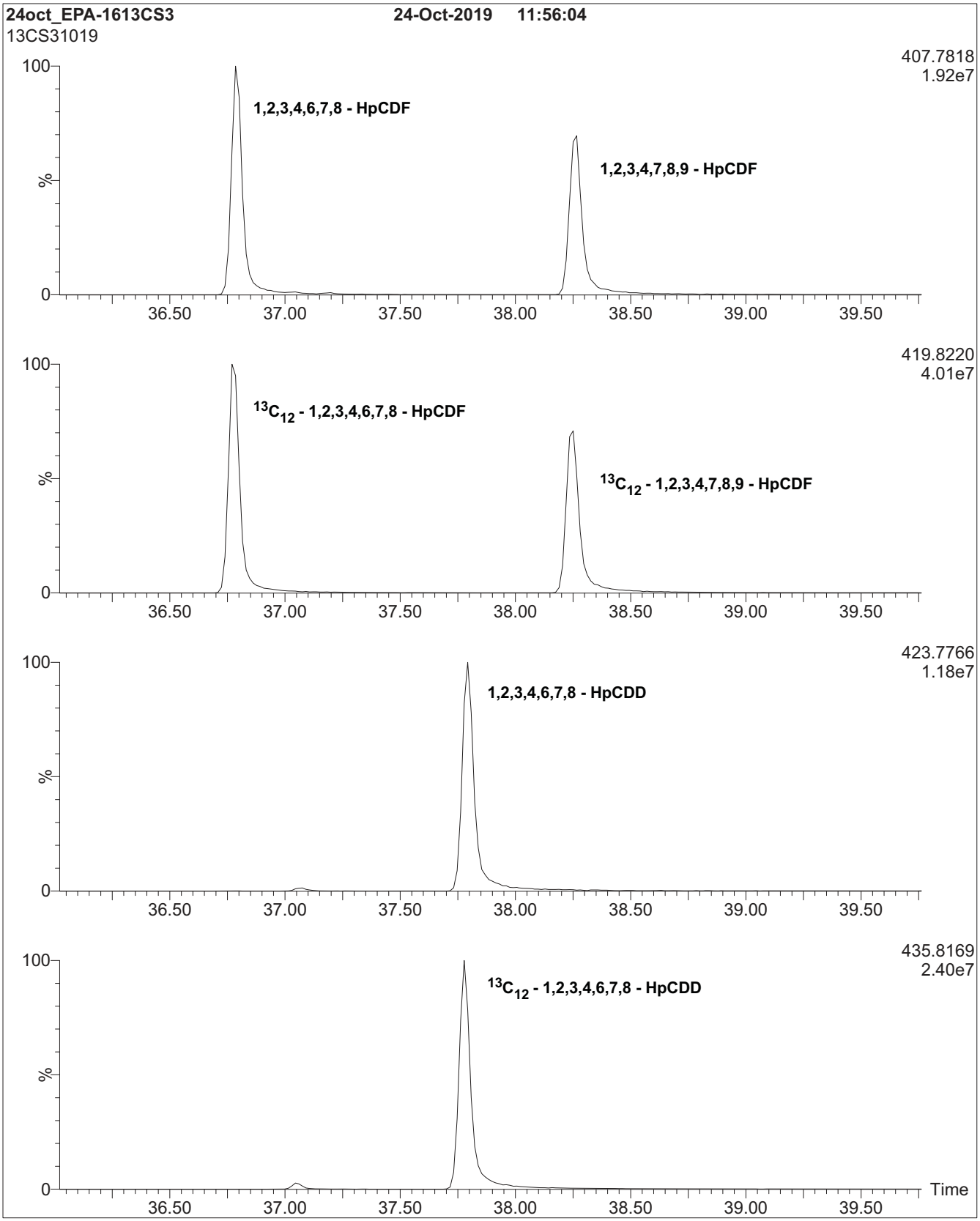
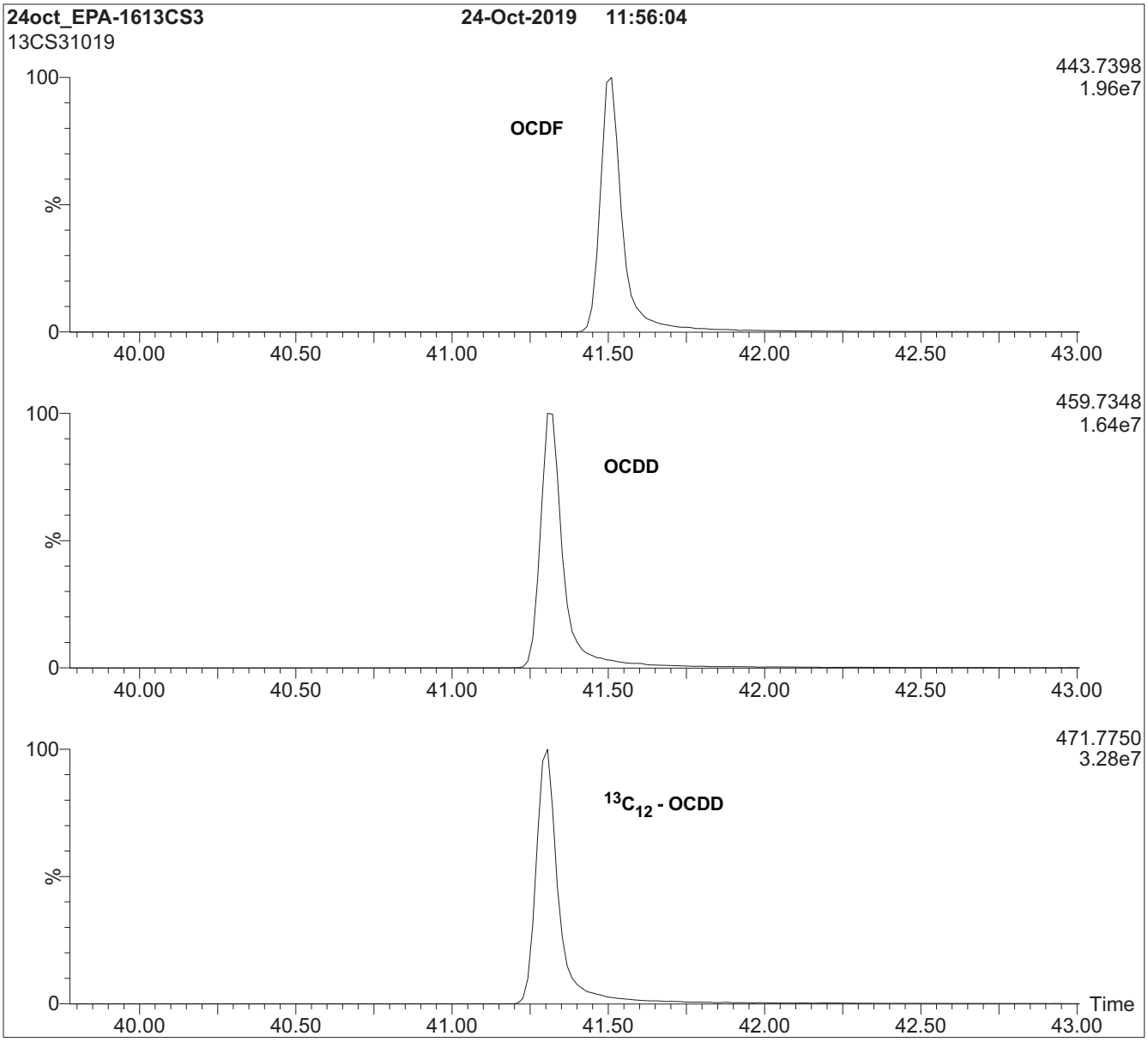


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**



HRGC/HRMS:

Agilent 6890N (HRGC)
Autospec Ultima (HRMS)

Chromatographic Conditions:

Column: 60 m DB-5 (0.25 mm id, 0.25 µm film thickness) Agilent J&W

Flow: Constant at 1 ml/min
Injector: 280 °C (Splitless Injection)
Ionization: EI+
Detector: 280 °C
SIR at 10,000 mass resolving power

Oven: 150 °C (1 min)
12 °C/min to 200 °C
3 °C/min to 235 °C
235 °C (8 min)
8 °C/min to 310 °C
310 °C (8 min)

WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

EPA-1613CVS

U.S. EPA Method 1613 Calibration and Verification Solutions
plus Supplemental Calibration Solutions EPA-1613CSL & EPA-1613CS0.5

PRODUCT CODES:	EPA-1613CVS	**LOT NUMBERS:**	(see below)
	EPA-1613CS1		13CS11019
	EPA-1613CS2		13CS21019
	EPA-1613CS3		13CS31019
	EPA-1613CS4		13CS41019
	EPA-1613CS5		13CS51019

Note: EPA-1613CSL and EPA-1613CS0.5 are lower level extensions to this calibration set that must be ordered separately.

EPA-1613CS0.5	13CS0.51019
EPA-1613CSL	13CSL1019

SOLVENT(S):	Nonane/Toluene
DATE PREPARED: (mm/dd/yyyy)	10/22/2019
LAST TESTED: (mm/dd/yyyy)	10/24/2019
EXPIRY DATE: (mm/dd/yyyy)	10/24/2026
RECOMMENDED STORAGE:	Store ampoules in a cool, dark place

I005460
1613 CSL CAL STD
Expires 10/24/2026
Prepared By Joshua Rains 6/23/2020

DESCRIPTION:

EPA-1613CVS is a series of 5 calibration solutions containing native ($^{12}C_{12}$) and mass-labelled ($^{13}C_{12}$ and $^{37}Cl_4$) chlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs). The components of each solution, and their concentrations, are given in Table A.

They were designed for, and prepared to be used according to, U.S. EPA Method 1613 (Revision B). They are to be used as received.

EPA-1613CSL and EPA-1613CS0.5 are lower level extensions to EPA-1613CVS. Neither is required by the method, but either or both can be used to extend the calibration to lower levels.

The individual native PCDDs and PCDFs all have chemical purities of >98%. The individual ^{13}C-labelled PCDDs and PCDFs all have chemical purities of >98% and isotopic purities of ≥99%. The 2,3,7,8-$^{37}Cl_4$-Tetrachlorodibenzo-p-dioxin has a chemical purity of >98% and an isotopic (^{37}Cl) purity of ≥95%.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations
Table B: 5-point HRGC/HRMS Calibration and RRF Summary
Table C: 7-point HRGC/HRMS Calibration and RRF Summary
Figure 1: HRGC/HRMS Data for EPA-1613CS3 (SIR; 10,000 mass resolving power)

ADDITIONAL INFORMATION:

- See page 3 for further details.

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a series of standards for the identification and quantification of specific chemical compounds.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned values, and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2,...x_n on which it depends is:

$$u_c(y(x_1, x_2, ...x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analytes is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A 1226), and ISO 17034 by ANSI-ASQ National Accreditation Board (ANAB; AR-1523).

CALA Testing Accreditation No. A 1226

ANAB ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Table A: **EPA-1613CVS (with EPA-1613CSL and EPA-1613CS0.5); Components and Concentrations (ng/ml, ± 5% in nonane/toluene)**

Compound	Concentration (ng/ml)						
Native PCDDs and PCDFs:	**CS1**	**CS2**	**CS3**	**CS4**	**CS5**	**CSL**	**CS0.5**
2,3,7,8-TCDD	0.5	2	10	40	200	0.1	0.25
2,3,7,8-TCDF	0.5	2	10	40	200	0.1	0.25
1,2,3,7,8-PeCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8-PeCDF	2.5	10	50	200	1000	0.5	1.25
2,3,4,7,8-PeCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,6,7,8-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8,9-HxCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,6,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,7,8,9-HxCDF	2.5	10	50	200	1000	0.5	1.25
2,3,4,6,7,8-HxCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,6,7,8-HpCDD	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,6,7,8-HpCDF	2.5	10	50	200	1000	0.5	1.25
1,2,3,4,7,8,9-HpCDF	2.5	10	50	200	1000	0.5	1.25
OCDD	5.0	20	100	400	2000	1.0	2.5
OCDF	5.0	20	100	400	2000	1.0	2.5
Labelled PCDDs and PCDFs:							
$^{13}C_{12}$-2,3,7,8-TCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,7,8-TCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8-PeCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8-PeCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,4,7,8-PeCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	100	100	100	100	100	100	100
$^{13}C_{12}$-OCDD	200	200	200	200	200	200	200
Cleanup Standard:							
$^{37}Cl_4$-2,3,7,8-TCDD	0.5	2	10	40	200	0.1	0.25
Internal Standards:							
$^{13}C_{12}$-1,2,3,4-TCDD	100	100	100	100	100	100	100
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	100	100	100	100	100	100	100
Percent toluene (v/v)	3.6%	3.7%	4.2%	6.1%	16.2%	3.6%	3.6%

Certified By: _____ **Date:** 10/25/2019
(mm/dd/yyyy)

B.G. Chittim, General Manager

Table B: **EPA-1613CVS; 5-point HRGC/HRMS Calibration and RRF Summary**

Calibration RRF Summary				Calibration Standard				
Calibration Filename: 24oct_EPA1613CVS-CAL.QLD				CS1	CS2	CS3	CS4	CS5
Name	Mean	S. D.	%RSD	RRF#1	RRF#2	RRF#3	RRF#4	RRF#5
2,3,7,8-TCDF	0.93	0.013	1.4	0.92	0.95	0.93	0.92	0.95
1,2,3,7,8-PeCDF	0.93	0.015	1.6	0.92	0.92	0.93	0.93	0.95
2,3,4,7,8-PeCDF	1.04	0.019	1.8	1.03	1.02	1.05	1.05	1.07
1,2,3,4,7,8-HxCDF	0.96	0.035	3.7	0.94	0.92	0.98	0.99	1.00
1,2,3,6,7,8-HxCDF	0.93	0.013	1.4	0.92	0.94	0.94	0.91	0.94
2,3,4,6,7,8-HxCDF	0.96	0.022	2.3	0.95	0.94	0.97	0.97	0.99
1,2,3,7,8,9-HxCDF	0.89	0.021	2.4	0.87	0.88	0.90	0.90	0.92
1,2,3,4,6,7,8-HpCDF	0.91	0.011	1.2	0.90	0.90	0.90	0.92	0.92
1,2,3,4,7,8,9-HpCDF	0.91	0.010	1.1	0.90	0.90	0.92	0.91	0.92
OCDF	1.19	0.056	4.7	1.11	1.17	1.19	1.23	1.26
2,3,7,8-TCDD	1.05	0.023	2.2	1.01	1.06	1.05	1.05	1.07
1,2,3,7,8-PeCDD	0.97	0.018	1.9	0.95	0.95	0.98	0.97	0.99
1,2,3,4,7,8-HxCDD	1.00	0.019	1.9	1.01	1.00	1.00	0.96	1.01
1,2,3,6,7,8-HxCDD	0.98	0.032	3.2	0.93	0.98	0.99	1.01	1.01
1,2,3,7,8,9-HxCDD	0.97	0.016	1.6	0.95	0.96	0.98	0.99	0.98
1,2,3,4,6,7,8-HpCDD	1.01	0.025	2.5	1.01	0.97	1.02	1.03	1.04
OCDD	1.00	0.013	1.3	1.00	0.99	1.02	1.02	1.00
$^{13}C_{12}$-2,3,7,8-TCDF	1.57	0.047	3.0	1.52	1.55	1.55	1.57	1.65
$^{13}C_{12}$-1,2,3,7,8-PeCDF	1.21	0.078	6.5	1.13	1.20	1.17	1.20	1.34
$^{13}C_{12}$-2,3,4,7,8-PeCDF	1.17	0.081	6.9	1.09	1.15	1.13	1.17	1.31
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1.33	0.020	1.5	1.35	1.33	1.33	1.32	1.30
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	1.51	0.034	2.2	1.47	1.48	1.53	1.53	1.54
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	1.38	0.012	0.9	1.38	1.38	1.40	1.37	1.36
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	1.19	0.014	1.2	1.18	1.16	1.20	1.19	1.20
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1.31	0.033	2.5	1.31	1.26	1.33	1.31	1.35
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	1.08	0.046	4.3	1.06	1.03	1.09	1.08	1.15
$^{13}C_{12}$-2,3,7,8-TCDD	1.13	0.036	3.2	1.10	1.11	1.11	1.13	1.19
$^{13}C_{12}$-1,2,3,7,8-PeCDD	0.79	0.047	5.9	0.74	0.78	0.75	0.79	0.86
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	0.87	0.027	3.1	0.85	0.83	0.89	0.88	0.89
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1.04	0.010	1.0	1.05	1.05	1.04	1.05	1.03
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	0.81	0.017	2.1	0.81	0.80	0.80	0.81	0.84
$^{13}C_{12}$-OCDD	0.74	0.055	7.4	0.70	0.70	0.73	0.72	0.83
$^{13}C_{12}$-1,2,3,4-TCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00
$^{37}Cl_4$-2,3,7,8-TCDD	0.97	0.026	2.6	0.95	0.94	0.99	0.99	0.99

Table C: **EPA-1613CVS (with EPA-1613CSL and EPA-1613CS0.5); 7-point HRGC/HRMS Calibration and RRF Summary**

Calibration RRF Summary				Calibration Standard						
Calibration Filename: 24oct_EPA1613CVS-CAL.QLD				CSL	CS0.5	CS1	CS2	CS3	CS4	CS5
Name	Mean	S. D.	%RSD	RRF#1	RRF#2	RRF#3	RRF#4	RRF#5	RRF#6	RRF#7
2,3,7,8-TCDF	0.92	0.045	4.8	0.96	0.83	0.92	0.95	0.93	0.92	0.95
1,2,3,7,8-PeCDF	0.93	0.013	1.4	0.94	0.92	0.92	0.92	0.93	0.93	0.95
2,3,4,7,8-PeCDF	1.02	0.058	5.7	0.90	1.00	1.03	1.02	1.05	1.05	1.07
1,2,3,4,7,8-HxCDF	0.96	0.029	3.0	0.96	0.97	0.94	0.92	0.98	0.99	1.00
1,2,3,6,7,8-HxCDF	0.92	0.030	3.3	0.90	0.86	0.92	0.94	0.94	0.91	0.94
2,3,4,6,7,8-HxCDF	0.94	0.047	5.0	0.87	0.89	0.95	0.94	0.97	0.97	0.99
1,2,3,7,8,9-HxCDF	0.88	0.029	3.3	0.83	0.88	0.87	0.88	0.90	0.90	0.92
1,2,3,4,6,7,8-HpCDF	0.90	0.033	3.7	0.83	0.93	0.90	0.90	0.90	0.92	0.92
1,2,3,4,7,8,9-HpCDF	0.91	0.018	1.9	0.89	0.94	0.90	0.90	0.92	0.91	0.92
OCDF	1.18	0.052	4.4	1.15	1.14	1.11	1.17	1.19	1.23	1.26
2,3,7,8-TCDD	1.03	0.051	5.0	1.03	0.92	1.01	1.06	1.05	1.05	1.07
1,2,3,7,8-PeCDD	0.95	0.042	4.4	0.87	0.98	0.95	0.95	0.98	0.97	0.99
1,2,3,4,7,8-HxCDD	0.97	0.066	6.8	0.83	0.98	1.01	1.00	1.00	0.96	1.01
1,2,3,6,7,8-HxCDD	0.96	0.044	4.5	0.90	0.92	0.93	0.98	0.99	1.01	1.01
1,2,3,7,8,9-HxCDD	0.94	0.054	5.7	0.83	0.92	0.95	0.96	0.98	0.99	0.98
1,2,3,4,6,7,8-HpCDD	1.01	0.033	3.3	0.95	1.03	1.01	0.97	1.02	1.03	1.04
OCDD	1.00	0.023	2.3	0.95	1.00	1.00	0.99	1.02	1.02	1.00
$^{13}C_{12}$-2,3,7,8-TCDF	1.56	0.042	2.7	1.52	1.54	1.52	1.55	1.55	1.57	1.65
$^{13}C_{12}$-1,2,3,7,8-PeCDF	1.20	0.066	5.5	1.18	1.17	1.13	1.20	1.17	1.20	1.34
$^{13}C_{12}$-2,3,4,7,8-PeCDF	1.16	0.071	6.1	1.12	1.13	1.09	1.15	1.13	1.17	1.31
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	1.33	0.018	1.4	1.32	1.35	1.35	1.33	1.33	1.32	1.30
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	1.53	0.045	3.0	1.60	1.56	1.47	1.48	1.53	1.53	1.54
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	1.39	0.019	1.4	1.39	1.42	1.38	1.38	1.40	1.37	1.36
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	1.19	0.012	1.0	1.19	1.19	1.18	1.16	1.20	1.19	1.20
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	1.31	0.028	2.2	1.30	1.33	1.31	1.26	1.33	1.31	1.35
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	1.07	0.045	4.2	1.02	1.08	1.06	1.03	1.09	1.08	1.15
$^{13}C_{12}$-2,3,7,8-TCDD	1.12	0.033	3.0	1.09	1.11	1.10	1.11	1.11	1.13	1.19
$^{13}C_{12}$-1,2,3,7,8-PeCDD	0.78	0.040	5.1	0.75	0.78	0.74	0.78	0.75	0.79	0.86
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	0.87	0.025	2.9	0.86	0.90	0.85	0.83	0.89	0.88	0.89
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	1.05	0.015	1.5	1.08	1.06	1.05	1.05	1.04	1.05	1.03
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	0.81	0.016	2.0	0.79	0.81	0.81	0.80	0.80	0.81	0.84
$^{13}C_{12}$-OCDD	0.73	0.046	6.3	0.71	0.72	0.70	0.70	0.73	0.72	0.83
$^{13}C_{12}$-1,2,3,4-TCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.00	0.000	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$^{37}Cl_4$-2,3,7,8-TCDD	0.97	0.053	5.4	0.90	1.07	0.95	0.94	0.99	0.99	0.99

Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

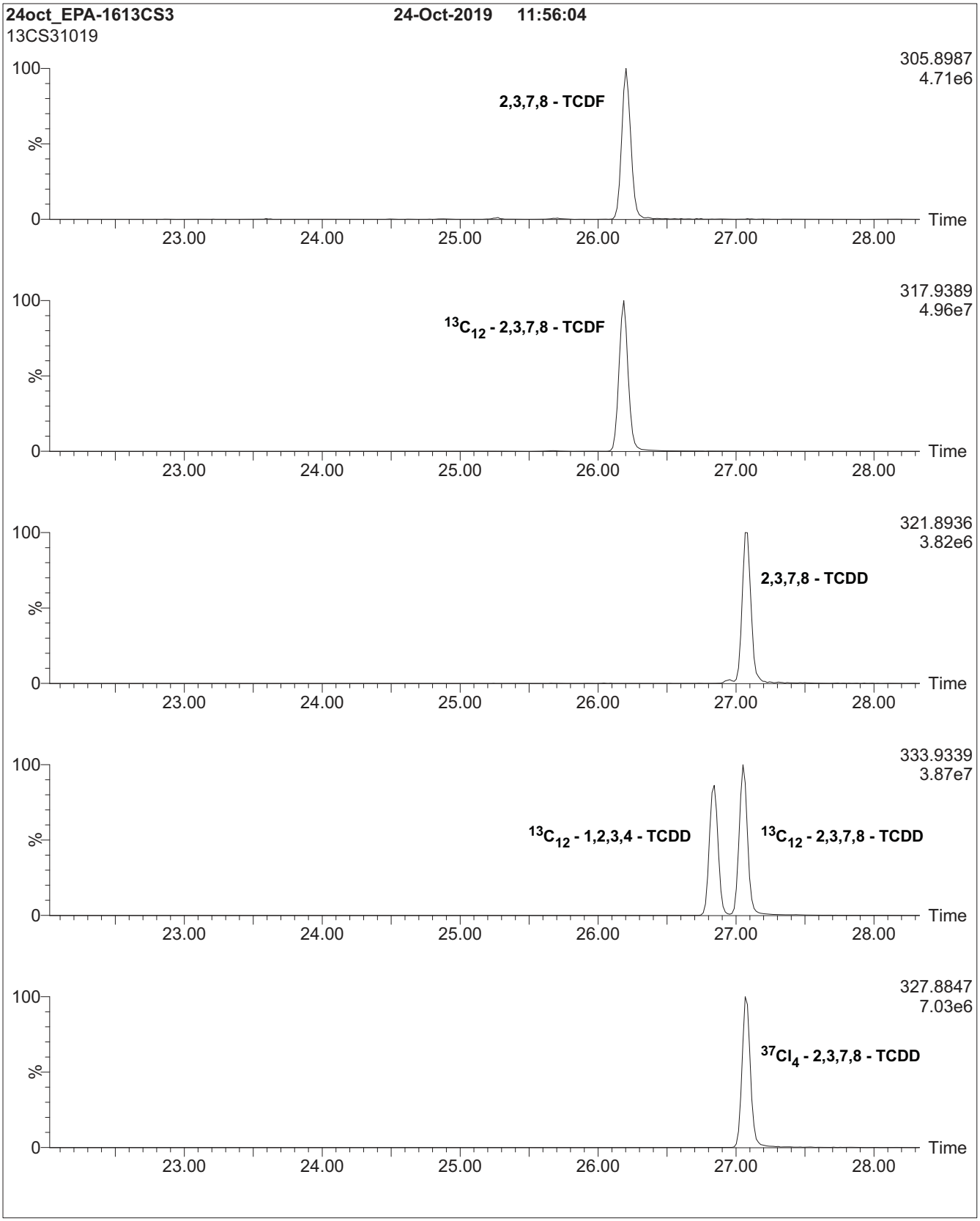


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

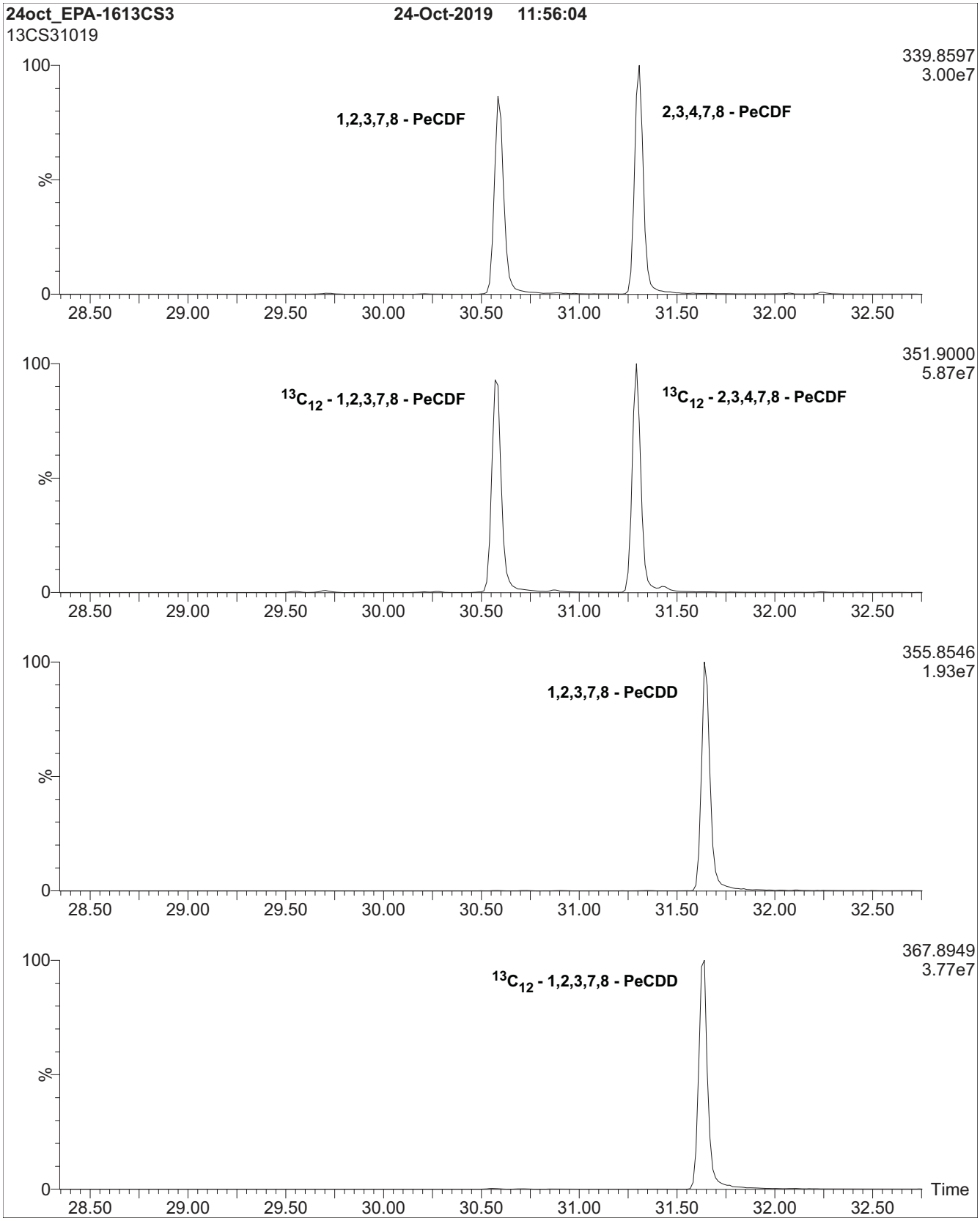


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

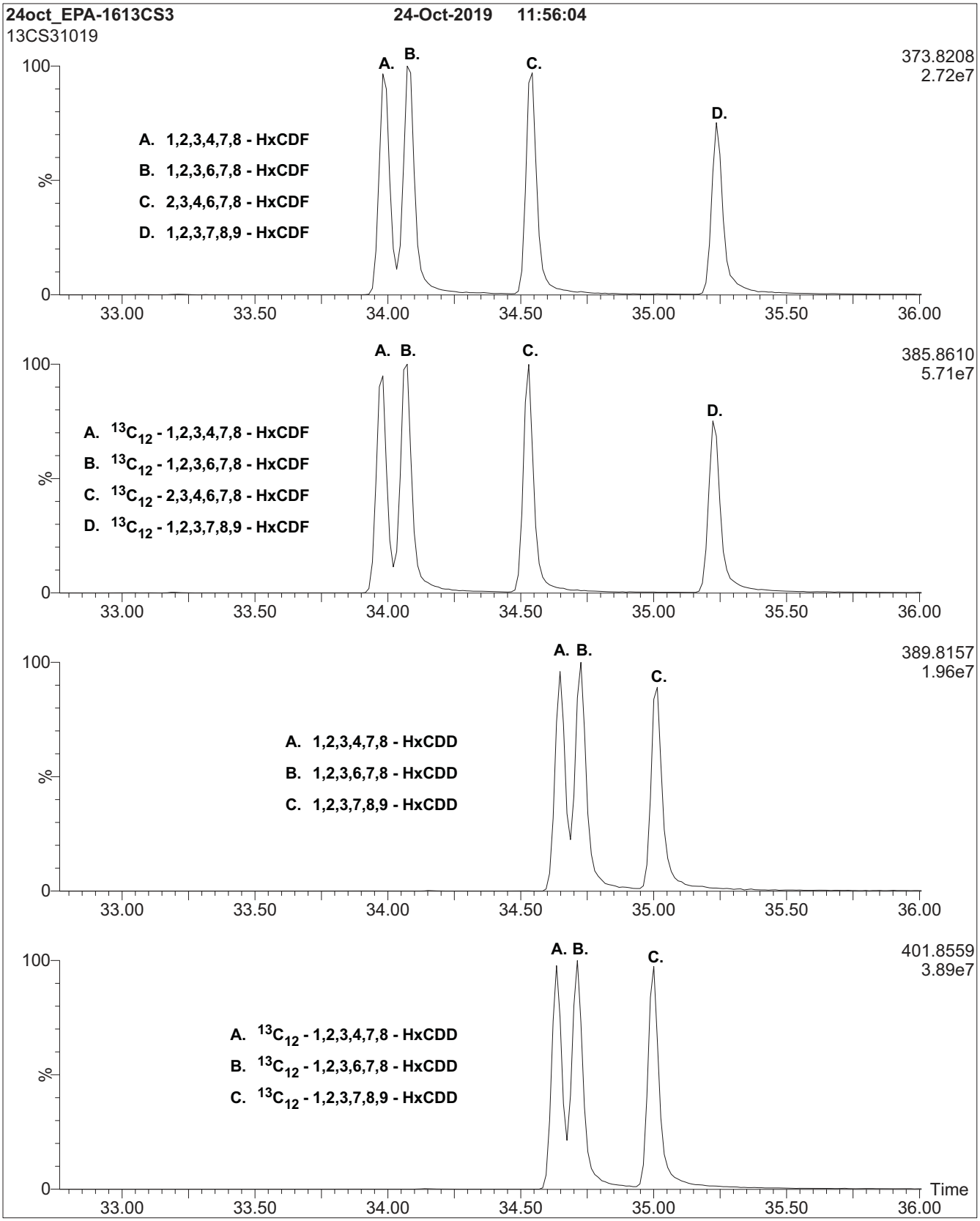


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**

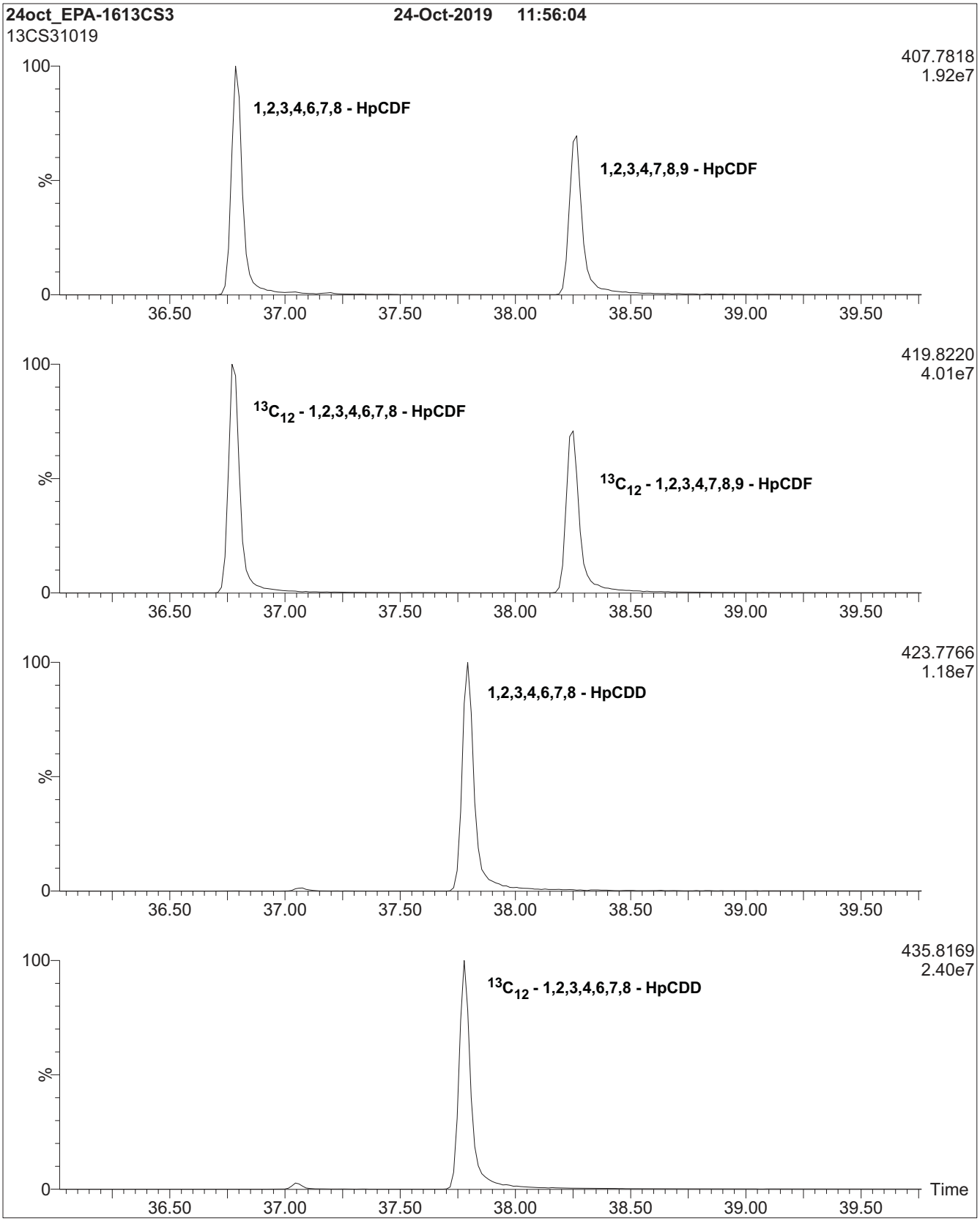
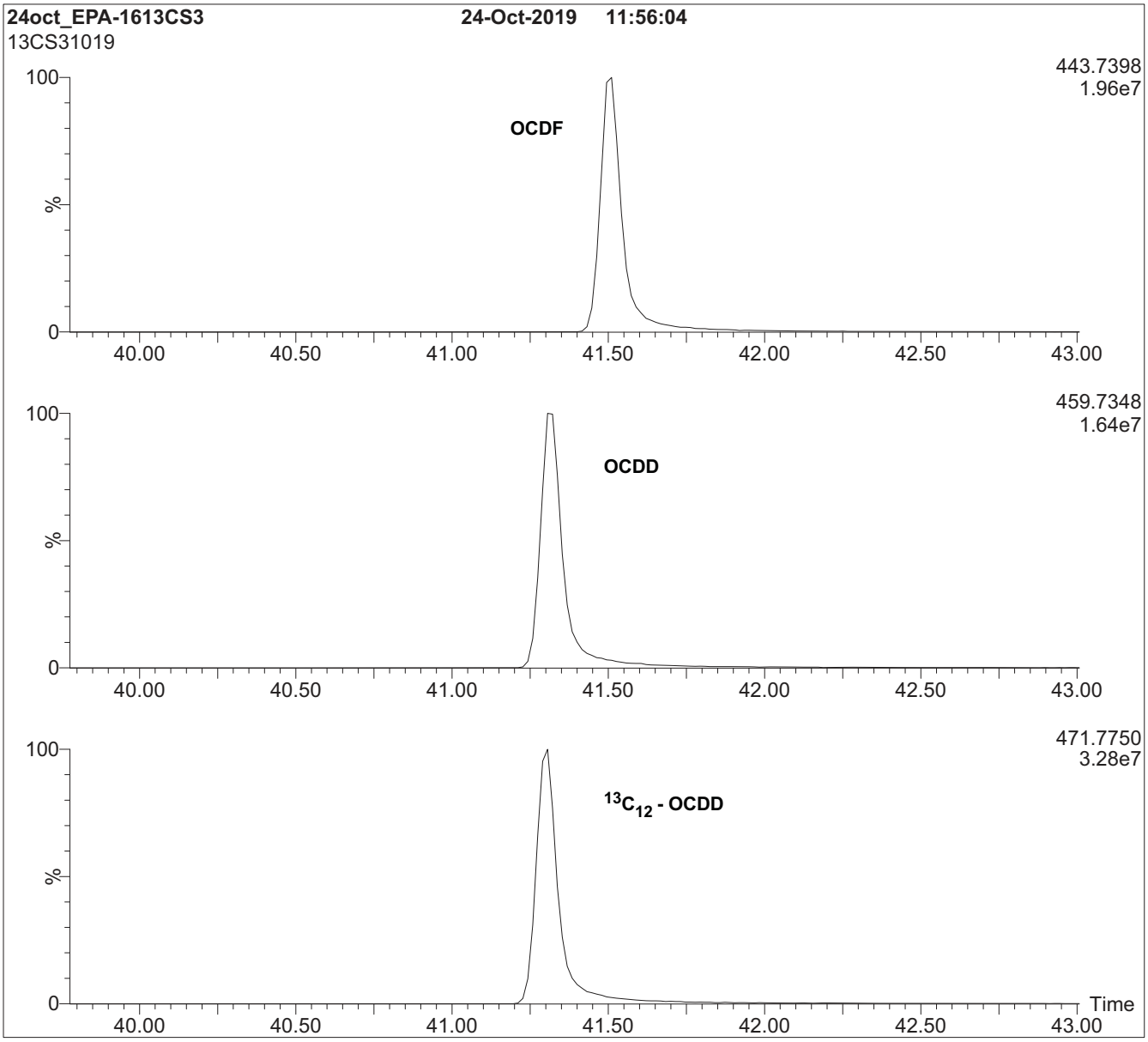


Figure 1: **EPA-1613CS3; HRGC/HRMS Data (60 m DB-5 Column)**



HRGC/HRMS:

Agilent 6890N (HRGC)
Autospec Ultima (HRMS)

Chromatographic Conditions:

Column: 60 m DB-5 (0.25 mm id, 0.25 µm film thickness) Agilent J&W

Flow: Constant at 1 ml/min
Injector: 280 °C (Splitless Injection)
Ionization: EI+
Detector: 280 °C
SIR at 10,000 mass resolving power

Oven: 150 °C (1 min)
12 °C/min to 200 °C
3 °C/min to 235 °C
235 °C (8 min)
8 °C/min to 310 °C
310 °C (8 min)

WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

CS3WT

Calibration and Verification Solution (EPA-1613CS3) combined with Window Defining and 2,3,7,8-TCDD Resolution Testing Congeners

PRODUCT CODE:	CS3WT
LOT NUMBER:	CS3WT1020
SOLVENT(S):	Nonane/Toluene
DATE PREPARED: (mm/dd/yyyy)	12/02/2020
LAST TESTED: (mm/dd/yyyy)	12/10/2020
EXPIRY DATE: (mm/dd/yyyy)	12/10/2027
RECOMMENDED STORAGE:	Store ampoule in a cool, dark place

J001522
1613 CS3WT CCAL STD
Expires 12/10/2027
Prepared By Joshua Rains 2/10/2021

DESCRIPTION:

CS3WT is a solution/mixture of native ($^{12}C_{12}$) and mass-labelled ($^{13}C_{12}$) polychlorinated dibenzo-*p*-dioxins (PCDDs) and dibenzofurans (PCDFs). The components and their concentrations are given in Tables A and B.

CS3WT is an HRGC/HRMS calibration solution that was designed and prepared to be used according to U.S. EPA Method 1613, Revision B, in place of EPA-1613CS3 (lot: 13CS31020). Additionally, it contains the PCDD and PCDF isomers required to set retention time windows as well as test and establish isomer specificity for 2,3,7,8-TCDD on a DB-5 (or equivalent) capillary column.

The individual ^{13}C-labelled PCDDs and PCDFs all have chemical purities of >98% and isotopic purities of ≥99%. The 2,3,7,8-($^{37}Cl_4$)tetrachlorodibenzo-*p*-dioxin has a chemical purity of >98% and an isotopic (^{37}Cl) purity of ≥95%. The individual native 2,3,7,8-substituted PCDD and PCDF congeners all have chemical purities of >98%; the other congeners (window defining and resolution testing) should only be considered semi-quantitative.

This current lot of CS3WT is to be used with the 1613 calibration solutions having the following lot numbers:

PRODUCT CODE	LOT NUMBER
EPA-1613CS1	13CS11020
EPA-1613CS2	13CS21020
EPA-1613CS3	13CS31020
EPA-1613CS4	13CS41020
EPA-1613CS5	13CS51020
EPA-1613CSL	13CSL1020
EPA-1613CS0.5	13CS0.51020

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

DOCUMENTATION/ DATA ATTACHED:

Table A: Quantitative Components and Concentrations of the Solution/Mixture
Table B: Semi-Quantitative Components and Concentrations of the Solution/Mixture
Figure 1: HRGC/HRMS Data (SIR; 10,000 mass resolving power)

ADDITIONAL INFORMATION:

- See page 3 for further details.
- Only the 2,3,7,8-substituted PCDDs and PCDFs should be used for quantitation. The other congeners (window defining and 2,3,7,8-TCDD resolution testing) should be considered semi-quantitative (within ±20% of their design value). Impurities have been identified where possible.

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2,...x_n on which it depends is:

$$u_c(y(x_1, x_2, ...x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) has been assigned to the quantitative components in this product. A maximum combined percent relative uncertainty of ±20% has been assigned to the semi-quantitative components in this product.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).

CALA Testing Accreditation No. A1226

ANAB ANSI National Accreditation Board ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Table A: **CS3WT; Quantitative Components and Concentrations (ng/mL, ± 5%, in nonane/4.5% toluene)**

Compound		Acronym	CAS #	Concentration (ng/mL)
Native PCDDs:	**Designation[a]**			
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin		2,3,7,8-TCDD	1746-01-6	10.0
1,2,3,7,8-Pentachlorodibenzo-*p*-dioxin		1,2,3,7,8-PeCDD	40321-76-4	50.0
1,2,3,4,7,8-Hexachlorodibenzo-*p*-dioxin		1,2,3,4,7,8-HxCDD	39227-28-6	50.0
1,2,3,6,7,8-Hexachlorodibenzo-*p*-dioxin		1,2,3,6,7,8-HxCDD	57653-85-7	50.0
1,2,3,7,8,9-Hexachlorodibenzo-*p*-dioxin	Last HxCDD[b]	1,2,3,7,8,9-HxCDD	19408-74-3	50.0
1,2,3,4,6,7,8-Heptachlorodibenzo-*p*-dioxin	Last HpCDD	1,2,3,4,6,7,8-HpCDD	35822-46-9	50.0
Octachlorodibenzo-*p*-dioxin		OCDD	3268-87-9	100
Native PCDFs:	**Designation[a]**			
2,3,7,8-Tetrachlorodibenzofuran		2,3,7,8-TCDF	51207-31-9	10.0
1,2,3,7,8-Pentachlorodibenzofuran		1,2,3,7,8-PeCDF	57117-41-6	50.0
2,3,4,7,8-Pentachlorodibenzofuran		2,3,4,7,8-PeCDF	57117-31-4	50.0
1,2,3,4,7,8-Hexachlorodibenzofuran		1,2,3,4,7,8-HxCDF	70648-26-9	50.0
1,2,3,6,7,8-Hexachlorodibenzofuran		1,2,3,6,7,8-HxCDF	57117-44-9	50.0
1,2,3,7,8,9-Hexachlorodibenzofuran		1,2,3,7,8,9-HxCDF	72918-21-9	50.0
2,3,4,6,7,8-Hexachlorodibenzofuran		2,3,4,6,7,8-HxCDF	60851-34-5	50.0
1,2,3,4,6,7,8-Heptachlorodibenzofuran	First HpCDF[c]	1,2,3,4,6,7,8-HpCDF	67562-39-4	50.0
1,2,3,4,7,8,9-Heptachlorodibenzofuran	Last HpCDF	1,2,3,4,7,8,9-HpCDF	55673-89-7	50.0
Octachlorodibenzofuran		OCDF	39001-02-0	100
Mass-Labelled PCDDs:				
2,3,7,8-Tetrachloro($^{13}C_{12}$)dibenzo-*p*-dioxin		$^{13}C_{12}$-2,3,7,8-TCDD	76523-40-5	100
1,2,3,7,8-Pentachloro($^{13}C_{12}$)dibenzo-*p*-dioxin		$^{13}C_{12}$-1,2,3,7,8-PeCDD	109719-79-1	100
1,2,3,4,7,8-Hexachloro($^{13}C_{12}$)dibenzo-*p*-dioxin		$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	109719-80-4	100
1,2,3,6,7,8-Hexachloro($^{13}C_{12}$)dibenzo-*p*-dioxin		$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	109719-81-5	100
1,2,3,4,6,7,8-Heptachloro($^{13}C_{12}$)dibenzo-*p*-dioxin		$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	109719-83-7	100
Octachloro($^{13}C_{12}$)dibenzo-*p*-dioxin		$^{13}C_{12}$-OCDD	114423-97-1	200
Mass-Labelled PCDFs:				
2,3,7,8-Tetrachloro($^{13}C_{12}$)dibenzofuran		$^{13}C_{12}$-2,3,7,8-TCDF	89059-46-1	100
1,2,3,7,8-Pentachloro($^{13}C_{12}$)dibenzofuran		$^{13}C_{12}$-1,2,3,7,8-PeCDF	109719-77-9	100
2,3,4,7,8-Pentachloro($^{13}C_{12}$)dibenzofuran		$^{13}C_{12}$-2,3,4,7,8-PeCDF	116843-02-8	100
1,2,3,4,7,8-Hexachloro($^{13}C_{12}$)dibenzofuran		$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	114423-98-2	100
1,2,3,6,7,8-Hexachloro($^{13}C_{12}$)dibenzofuran		$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	116843-03-9	100
1,2,3,7,8,9-Hexachloro($^{13}C_{12}$)dibenzofuran		$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	116843-04-0	100
2,3,4,6,7,8-Hexachloro($^{13}C_{12}$)dibenzofuran		$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	116843-05-1	100
1,2,3,4,6,7,8-Heptachloro($^{13}C_{12}$)dibenzofuran		$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	109719-84-8	100
1,2,3,4,7,8,9-Heptachloro($^{13}C_{12}$)dibenzofuran		$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	109719-94-0	100
Cleanup Standard:				
2,3,7,8-($^{37}Cl_4$)Tetrachlorodibenzo-*p*-dioxin		$^{37}Cl_4$-2,3,7,8-TCDD	85508-50-5	10.0
Internal Standards:				
1,2,3,4-Tetrachloro($^{13}C_{12}$)dibenzo-*p*-dioxin		$^{13}C_{12}$-1,2,3,4-TCDD	114423-99-3	100
1,2,3,7,8,9-Hexachloro($^{13}C_{12}$)dibenzo-*p*-dioxin		$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	109719-82-6	100

[a] First/Last eluting isomer for the specified homologue group (see Table B for additional Window Definers).
[b, c] – see Table B for footnote.

Table B: **CS3WT; Semi-Quantitative Components and Concentrations (ng/mL, ± 20%, in nonane/4.5% toluene)**

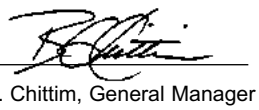
Compound		Acronym	CAS #	Concentration (ng/mL)
PCDD Window Definers:	**Designation[a]**			
1,3,6,8-Tetrachlorodibenzo-*p*-dioxin	First TCDD	1,3,6,8-TCDD	33423-92-6	10.0
1,2,8,9-Tetrachlorodibenzo-*p*-dioxin	Last TCDD	1,2,8,9-TCDD	62470-54-6	10.0
1,2,4,6,8-/1,2,4,7,9-Pentachlorodibenzo-*p*-dioxin	First PeCDD	1,2,4,6,8-PeCDD 1,2,4,7,9-PeCDD	71998-76-0 82291-37-0	50.0[d]
1,2,3,8,9-Pentachlorodibenzo-*p*-dioxin	Last PeCDD	1,2,3,8,9-PeCDD	71925-18-3	50.0
1,2,4,6,7,9-Hexachlorodibenzo-*p*-dioxin	First HxCDD	1,2,4,6,7,9-HxCDD	39227-62-8	50.0
1,2,3,4,6,7,9-Heptachlorodibenzo-*p*-dioxin	First HpCDD	1,2,3,4,6,7,9-HpCDD	58200-70-7	50.0
PCDF Window Definers:	**Designation[a]**			
1,3,6,8-Tetrachlorodibenzofuran	First TCDF	1,3,6,8-TCDF	71998-72-6	10.0
1,2,8,9-Tetrachlorodibenzofuran	Last TCDF	1,2,8,9-TCDF	70648-22-5	10.0
1,3,4,6,8-Pentachlorodibenzofuran	First PeCDF	1,3,4,6,8-PeCDF	83704-55-6	50.0
1,2,3,8,9-Pentachlorodibenzofuran	Last PeCDF	1,2,3,8,9-PeCDF	83704-54-5	50.0
1,2,3,4,6,8-Hexachlorodibenzofuran	First HxCDF	1,2,3,4,6,8-HxCDF	69698-60-8	50.0
2,3,7,8-TCDD Resolution Testing Isomers:				
1,2,3,4-Tetrachlorodibenzo-*p*-dioxin		1,2,3,4-TCDD	30746-58-8	5.00
1,2,3,7-/1,2,3,8-Tetrachlorodibenzo-*p*-dioxin		1,2,3,7-TCDD 1,2,3,8-TCDD	67028-18-6 53555-02-5	5.00[d]
1,2,3,9-Tetrachlorodibenzo-*p*-dioxin		1,2,3,9-TCDD	71669-26-6	10.0

[a] First/Last eluting isomer for the specified homologue group (see Table A for additional Window Definers).

[b] 1,2,3,4,6,7-HxCDD (last eluting HxCDD) not included; coelutes with 1,2,3,7,8,9-HxCDD on a 60 m DB-5 column. Use 1,2,3,7,8,9-HxCDD (see Table A) and 1,2,3,4,6,7,9-HpCDD to approximate the end of the HxCDD window.

[c] 1,2,3,4,8,9-HxCDF (last eluting HxCDF) not included; can interfere with 1,2,3,7,8,9-HxCDF on a 60 m DB-5 column. Use 1,2,3,4,6,7,8-HpCDF (see Table A) to approximate the end of the HxCDF window.

[d] Total concentration of isomers.

Certified By:  **Date:** 09/17/2021
(mm/dd/yyyy)

B.G. Chittim, General Manager

Figure 1: **CS3WT; HRGC/HRMS Data (60 m DB-5 Column)**

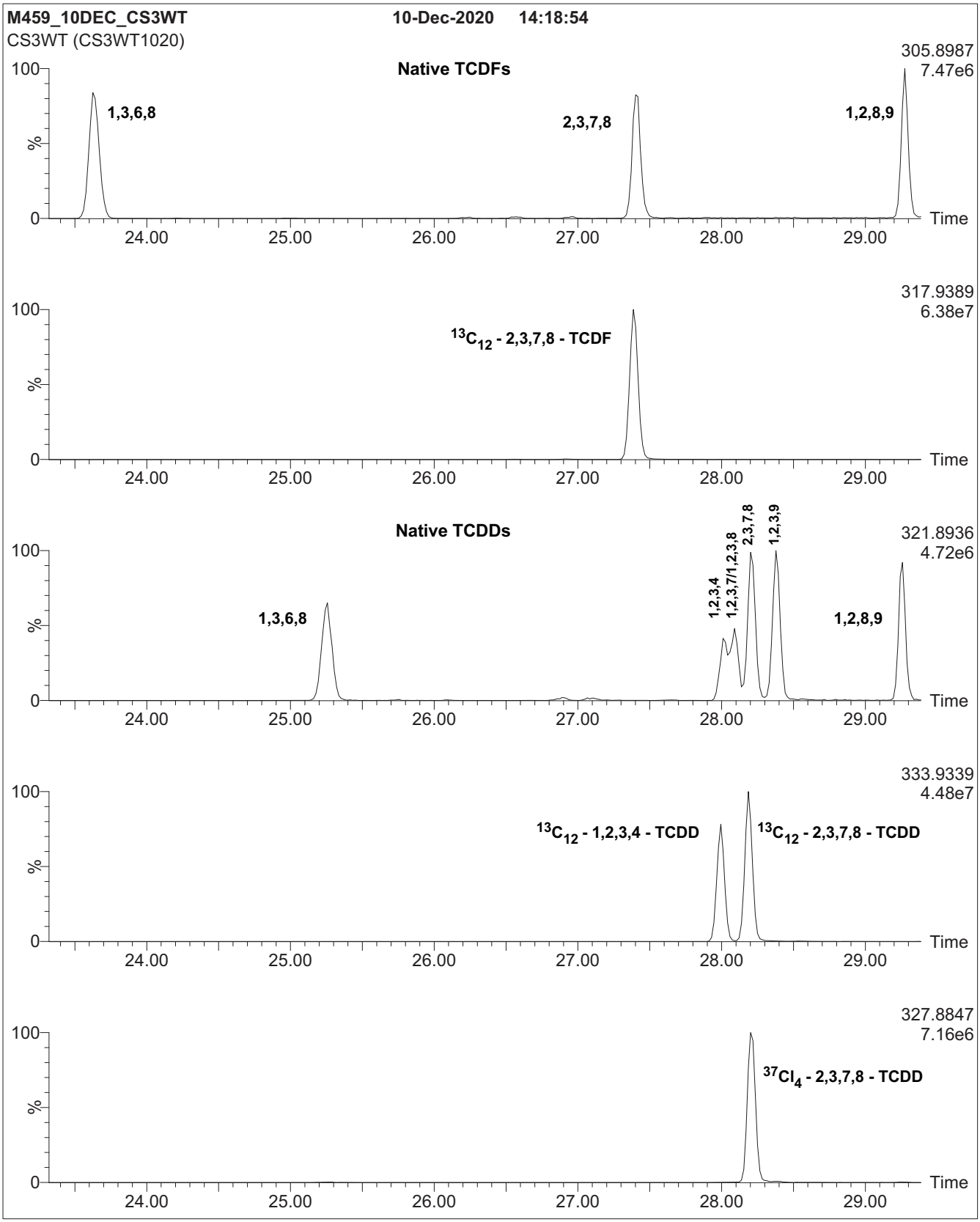


Figure 1: **CS3WT; HRGC/HRMS Data (60 m DB-5 Column)**

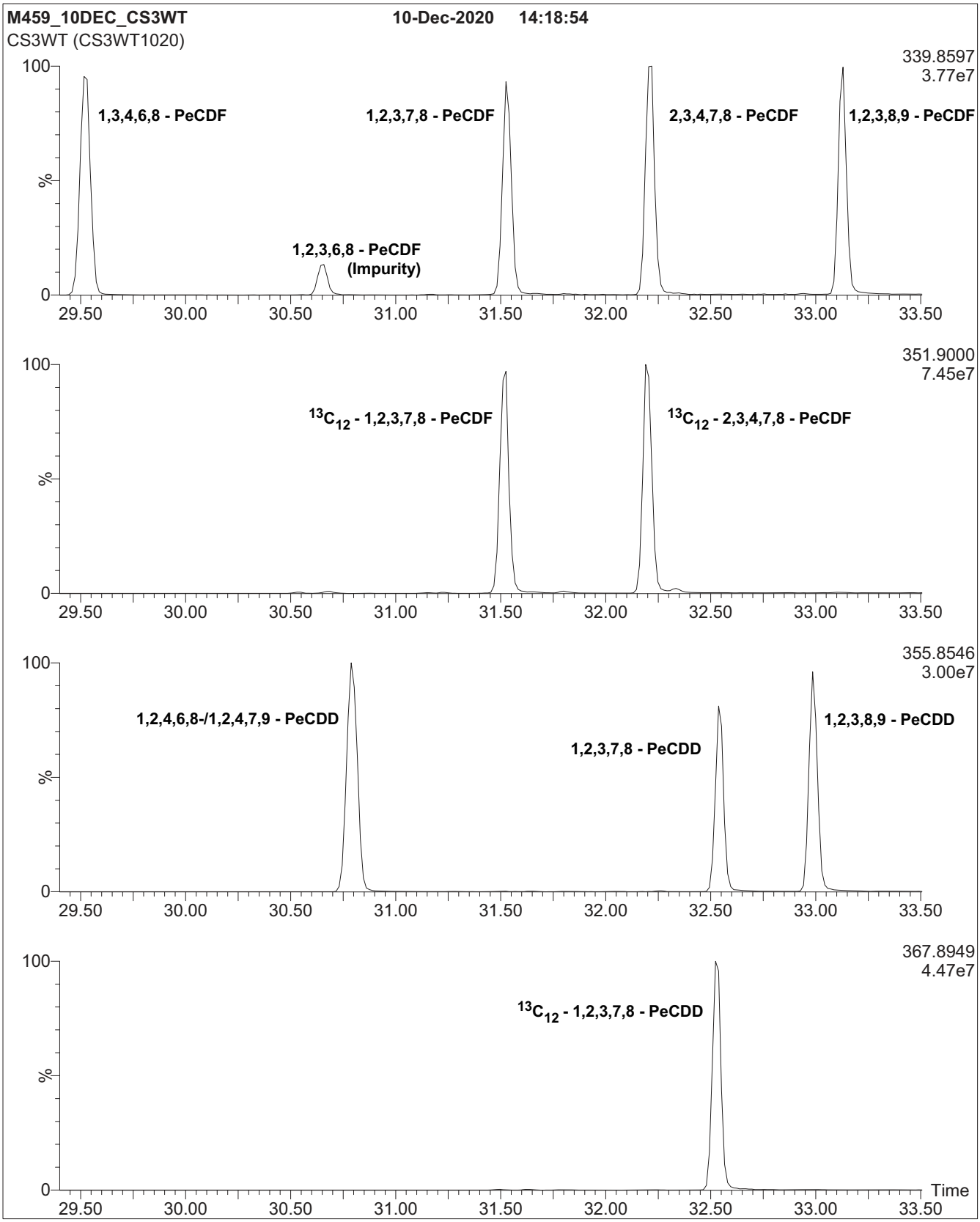


Figure 1: **CS3WT; HRGC/HRMS Data (60 m DB-5 Column)**

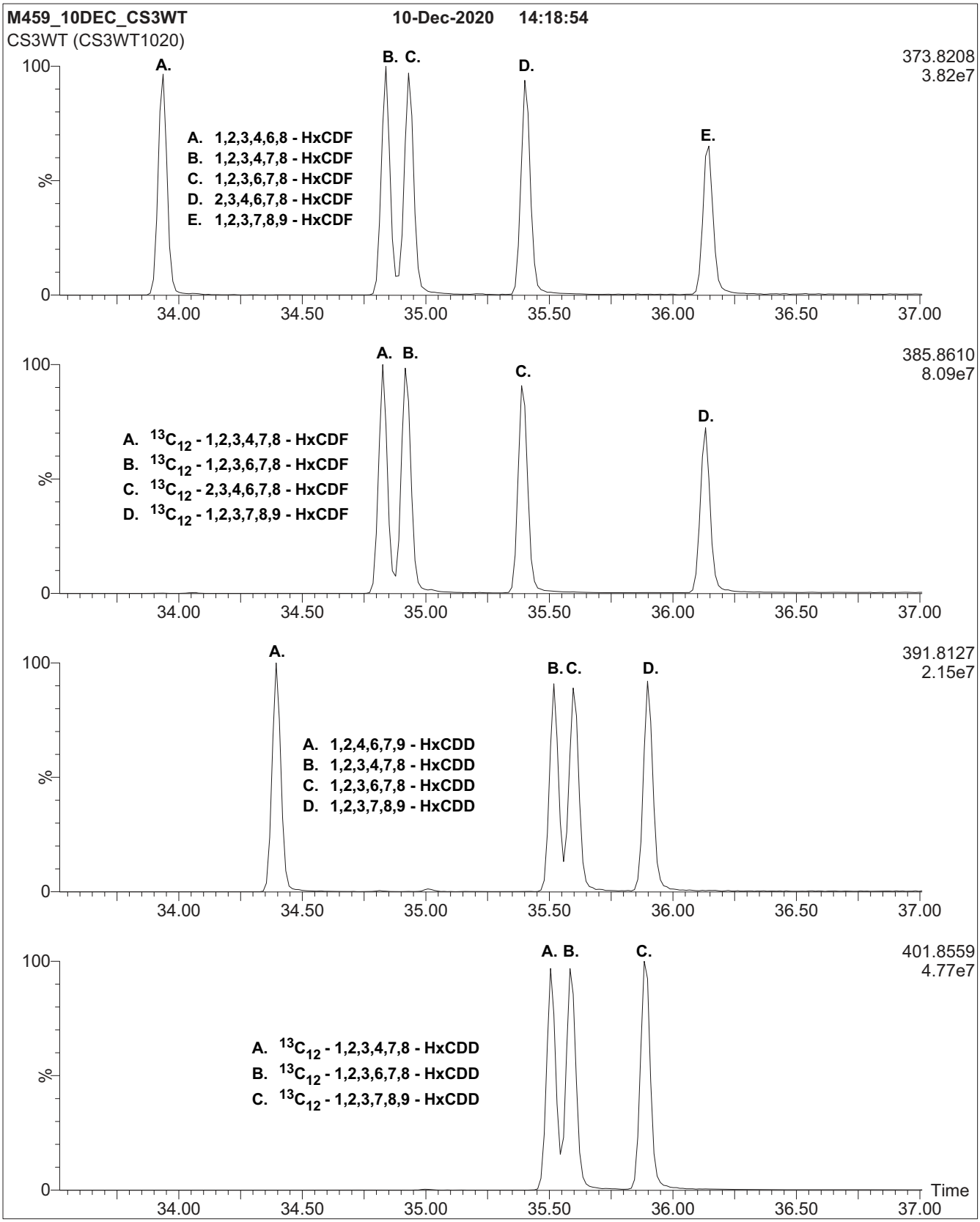


Figure 1: **CS3WT; HRGC/HRMS Data (60 m DB-5 Column)**

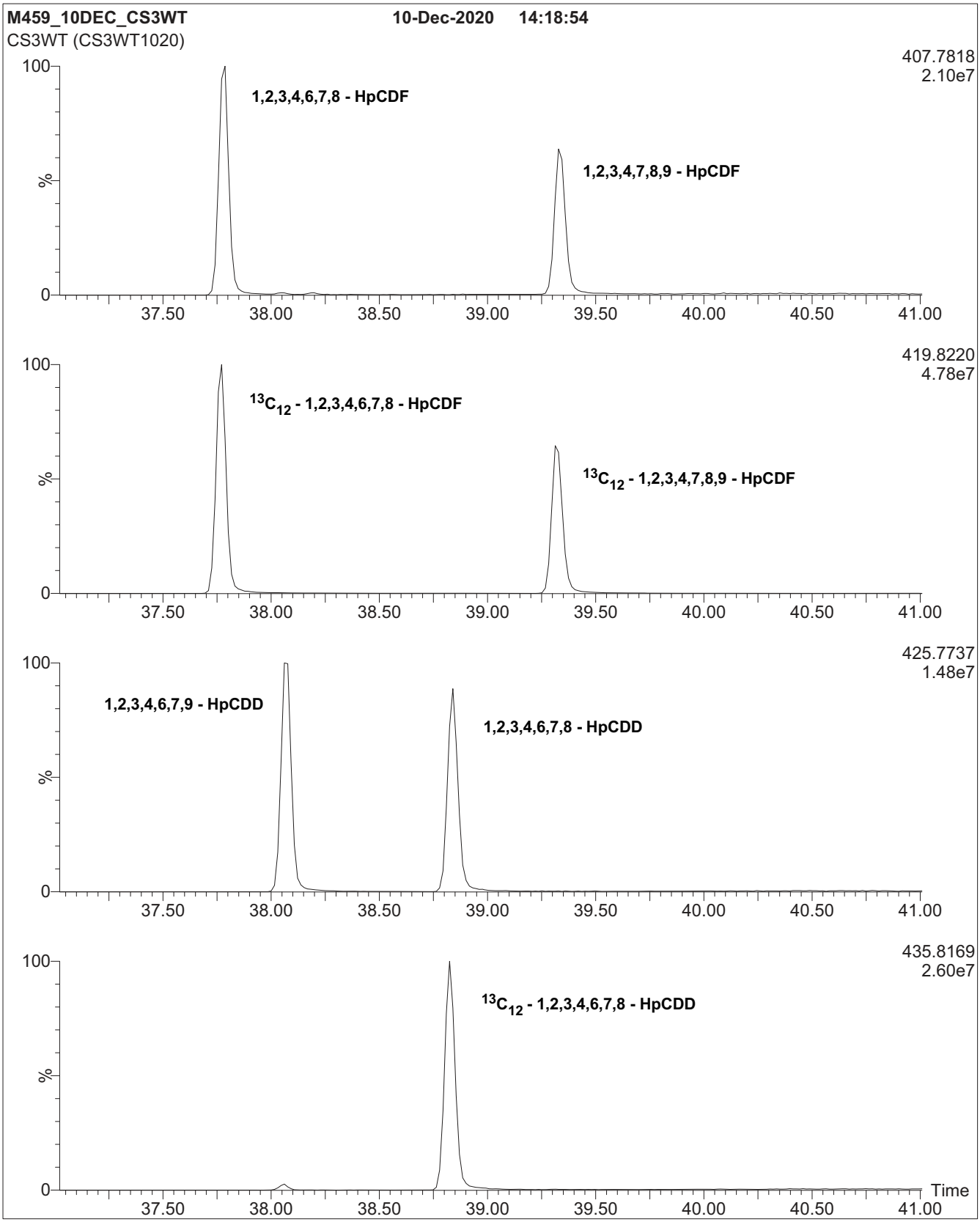
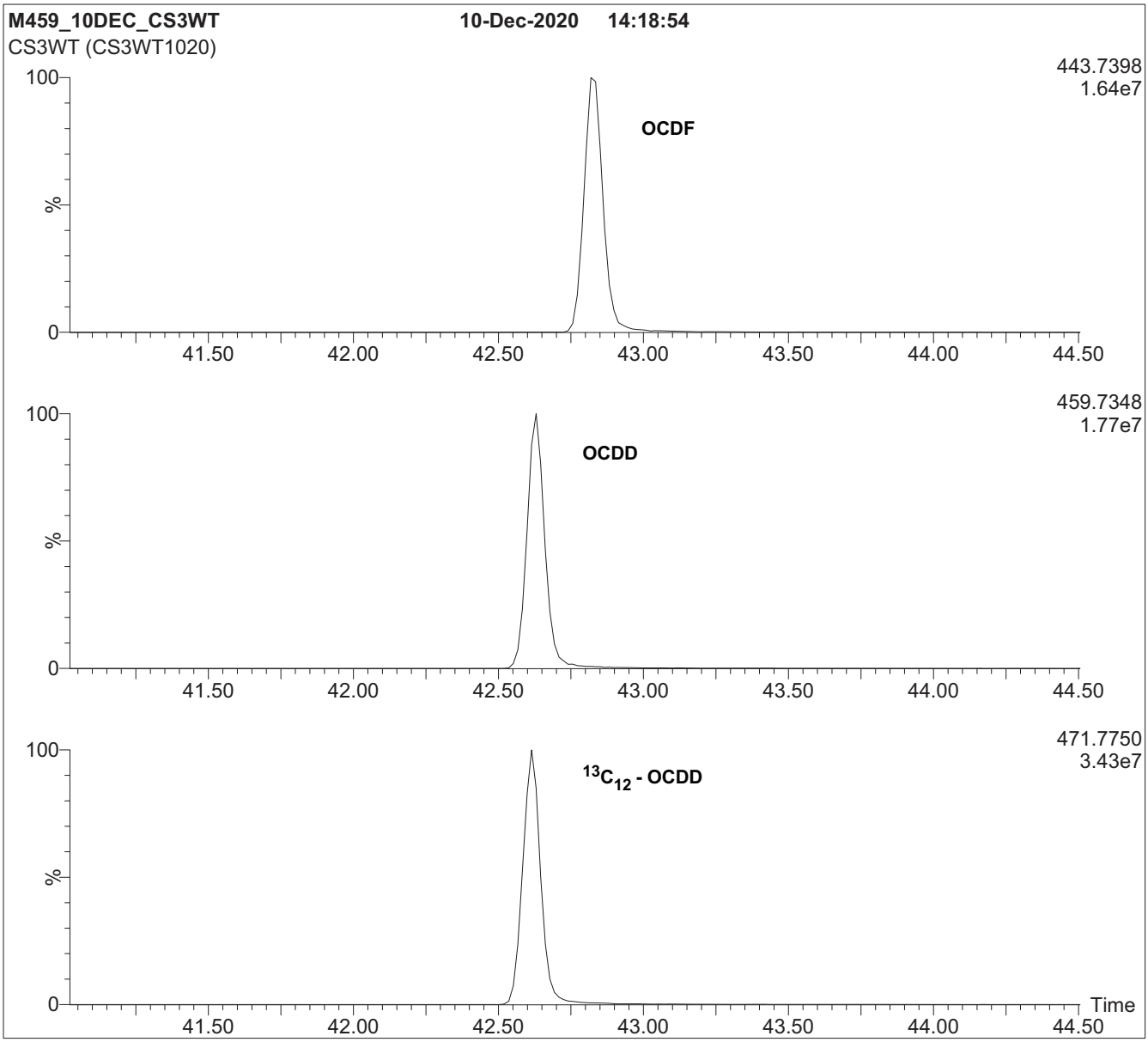


Figure 1: **CS3WT; HRGC/HRMS Data (60 m DB-5 Column)**



Conditions for Figure 1:

Agilent 6890N HRGC
Autospec Ultima HRMS

Chromatographic Conditions:

Column:	60 m DB-5 (0.25 mm id, 0.25 µm film thickness) Agilent J&W		
Flow:	Constant at 1 mL/min	Oven:	150°C (1 min)
Injector:	280°C (Splitless Injection)		12°C/min to 200°C
Ionization:	EI+		3°C/min to 235°C
Detector:	280°C		235°C (8 min)
	SIR at 10,000 mass resolving power		8°C/min to 310°C
			310°C (8 min)

WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

EPA-1613CSS

J012606

1613B Stock Cleanup Std
Expires 10/31/2028
Prepared By Joshua Rains 11/29/2021

U.S. EPA Method 1613 Cleanup Standard Spiking Solution

PRODUCT CODE:	EPA-1613CSS
LOT NUMBER:	13CSS1021
SOLVENT(S):	Nonane
DATE PREPARED: (mm/dd/yyyy)	10/29/2021
LAST TESTED: (mm/dd/yyyy)	10/31/2021
EXPIRY DATE: (mm/dd/yyyy)	10/31/2028
RECOMMENDED STORAGE:	Store ampoule in a cool, dark place

DESCRIPTION:

EPA-1613CSS contains 2,3,7,8-($^{37}Cl_4$)tetrachlorodibenzo-*p*-dioxin at the concentration given in Table A.

EPA-1613CSS was designed and prepared to be used according to U.S. EPA Method 1613, Revision B.

2,3,7,8-($^{37}Cl_4$)Tetrachlorodibenzo-*p*-dioxin has a chemical purity of >98% and an isotopic (^{37}Cl) purity of ≥95%.

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations of the Solution
Figure 1: HRGC/HRMS Data (SIR; 10,000 mass resolving power)

ADDITIONAL INFORMATION:

- See page 2 for further details.

Table A: **EPA-1613CSS; Components and Concentrations (ng/mL, ± 5% in nonane)**

Compound	Acronym	CAS #	Concentration (ng/mL)
2,3,7,8-($^{37}Cl_4$)Tetrachlorodibenzo-*p*-dioxin	$^{37}Cl_4$-2,3,7,8-TCDD	85508-50-5	40.0

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Certified By: _____ **Date:** 11/05/2021 (mm/dd/yyyy)
B.G. Chittim, General Manager

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

INTENDED USE:

The products prepared by Wellington Laboratories Inc. are for laboratory use only. This certified reference material (CRM) was designed to be used as a standard for the identification and/or quantification of the specific chemical compounds it contains.

HANDLING:

This product should only be used by qualified personnel familiar with its potential hazards and trained in the handling of hazardous chemicals. Due care should be exercised to prevent unnecessary human contact or ingestion. All procedures should be carried out in a well-functioning fume hood and suitable gloves, eye protection, and clothing should be worn at all times. Waste should be disposed of according to national and regional regulations. Safety Data Sheets (SDSs) are available upon request.

SYNTHESIS / CHARACTERIZATION:

Our products are synthesized using single-product unambiguous routes whenever possible. They are then characterized, and their structures and purities confirmed, using a combination of the most relevant techniques, such as NMR, GC/MS, LC/MS/MS, SFC/UV/MS/MS, x-ray crystallography, and melting point. Isotopic purities of mass-labelled compounds are also confirmed using HRGC/HRMS and/or LC/MS/MS.

HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

The maximum combined relative standard uncertainty of our reference standard solutions is calculated using the following equation:

The combined relative standard uncertainty, $u_c(y)$, of a value y and the uncertainty of the independent parameters x_1, x_2,...x_n on which it depends is:

$$u_c(y(x_1, x_2, ...x_n)) = \sqrt{\sum_{i=1}^{n} u(y, x_i)^2}$$

where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

TRACEABILITY:

All reference standard solutions are traceable to specific crystalline lots. The microbalances used for solution preparation are regularly calibrated by an external ISO/IEC 17025 accredited laboratory. In addition, their calibration is verified prior to each weighing using calibrated external weights traceable to an ISO/IEC 17025 accredited laboratory. All volumetric glassware used is calibrated, of Class A tolerance, and traceable to an ISO/IEC 17025 accredited laboratory. For certain products, traceability to international interlaboratory studies has also been established.

EXPIRY DATE / PERIOD OF VALIDITY:

Ongoing stability studies of this product have demonstrated stability in its composition and concentration, until the specified expiry date, in the unopened ampoule. Monitoring for any degradation or change in concentration of the listed analyte(s) is performed on a routine basis.

LIMITED WARRANTY:

At the time of shipment, all products are warranted to be free of defects in material and workmanship and to conform to the stated technical and purity specifications.

QUALITY MANAGEMENT:

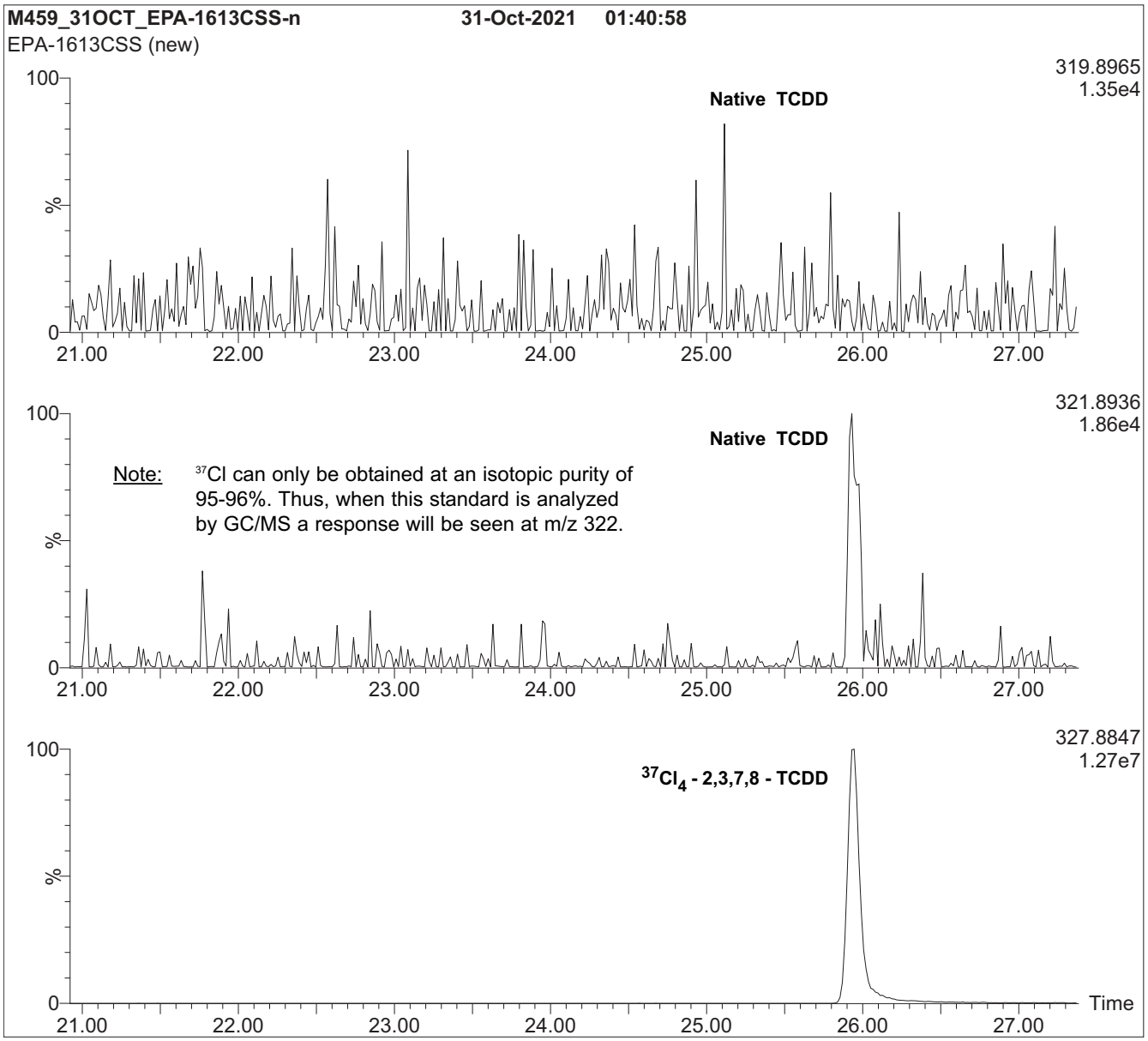
This product was produced using a Quality Management System registered to the latest versions of ISO 9001 by SAI Global, ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA; A1226), and ISO 17034 by ANSI National Accreditation Board (ANAB; AR-1523).

CALA Testing Accreditation No. A1226

ANAB ANSI National Accreditation Board ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Figure 1: **EPA-1613CSS; HRGC/HRMS Data (60 m DB-5 Column)**



Conditions for Figure 1:

Agilent 6890N HRGC
Autospec Ultima HRMS

Chromatographic Conditions:

Column:	60 m DB-5 (0.25 mm id, 0.25 µm film thickness) Agilent J&W		
Flow:	Constant at 1.4 mL/min	Oven:	150°C (1 min)
Injector:	280°C (Splitless Injection)		12°C/min to 200°C
Ionization:	EI+		3°C/min to 235°C
Detector:	280°C		235°C (8 min)
	SIR at 10,000 mass resolving power		8°C/min to 310°C
			310°C (8 min)

WELLINGTON LABORATORIES

CERTIFICATE OF ANALYSIS
DOCUMENTATION

EPA-1613LCS

U.S. EPA Method 1613
Labelled Compound Stock Solution

J012607
1613B Stock Surr Std
Expires 10/31/2028
Prepared By Joshua Rains 11/29/2021

PRODUCT CODE:	EPA-1613LCS
LOT NUMBER:	13LCS1021
SOLVENT(S):	Nonane/Toluene
DATE PREPARED: (mm/dd/yyyy)	10/29/2021
LAST TESTED: (mm/dd/yyyy)	10/31/2021
EXPIRY DATE: (mm/dd/yyyy)	10/31/2028
RECOMMENDED STORAGE:	Store ampoule in a cool, dark place

DESCRIPTION:

EPA-1613LCS is a solution/mixture of mass-labelled ($^{13}C_{12}$) polychlorinated dibenzo-*p*-dioxins (PCDDs) and dibenzofurans (PCDFs). The components and their concentrations are given in Table A.

EPA-1613LCS was designed and prepared to be used according to U.S. EPA Method 1613, Revision B.

The individual ^{13}C-labelled PCDDs and PCDFs all have chemical purities of >98% and isotopic purities of ≥99%.

DOCUMENTATION/ DATA ATTACHED:

Table A: Components and Concentrations
Figure 1: HRGC/HRMS Data (SIR; 10,000 mass resolving power)

ADDITIONAL INFORMATION:

- See page 2 for further details.

FOR LABORATORY USE ONLY: NOT FOR HUMAN OR DRUG USE

Wellington Laboratories Inc., 345 Southgate Dr. Guelph ON N1G 3M5 CANADA
519-822-2436 • Fax: 519-822-2849 • info@well-labs.com

INTENDED USE:

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SYNTHESIS / CHARACTERIZATION:

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HOMOGENEITY:

Prior to solution preparation, crystalline material is tested for homogeneity using a variety of techniques (as stated above) and its solubility in a given diluent is taken into consideration. Duplicate solutions of a new product are prepared from the same crystalline lot and, after the addition of an appropriate internal standard, they are compared by GC/MS, LC/MS/MS, and/or SFC/UV/MS/MS. The relative response factors of the analyte of interest in each solution are required to be <5% RSD. New solution lots of existing products, as well as mixtures and calibration solutions, are compared to older lots in a similar manner. This further confirms the homogeneity of the crystalline material as well as the stability and homogeneity of the solutions in the storage containers. In order to maintain the integrity of the assigned value(s), and associated uncertainty, the dilution or injection of a subsample of this product should be performed using calibrated measuring equipment.

UNCERTAINTY:

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where x is expressed as a relative standard uncertainty of the individual parameter.

The individual uncertainties taken into account include those associated with weights (calibration of the balance) and volumes (calibration of the volumetric glassware). An expanded maximum combined percent relative uncertainty of ±5% (calculated with a coverage factor of 2 and a level of confidence of 95%) is stated on the Certificate of Analysis for all of our products.

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EXPIRY DATE / PERIOD OF VALIDITY:

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CALA Testing Accreditation No. A1226

ANAB ANSI National Accreditation Board ACCREDITED ISO 17034 REFERENCE MATERIAL PRODUCER

For additional information or assistance concerning this or any other products from Wellington Laboratories Inc., please visit our website at www.well-labs.com or contact us directly at info@well-labs.com

Table A: **EPA-1613LCS; Components and Concentrations (ng/mL, ± 5% in nonane/3.2% toluene)**

Compound	Acronym	CAS #	Concentration (ng/mL)
Mass-Labelled PCDDs:			
2,3,7,8-Tetrachloro($^{13}C_{12}$)dibenzo-*p*-dioxin	$^{13}C_{12}$-2,3,7,8-TCDD	76523-40-5	100
1,2,3,7,8-Pentachloro($^{13}C_{12}$)dibenzo-*p*-dioxin	$^{13}C_{12}$-1,2,3,7,8-PeCDD	109719-79-1	100
1,2,3,4,7,8-Hexachloro($^{13}C_{12}$)dibenzo-*p*-dioxin	$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	109719-80-4	100
1,2,3,6,7,8-Hexachloro($^{13}C_{12}$)dibenzo-*p*-dioxin	$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	109719-81-5	100
1,2,3,4,6,7,8-Heptachloro($^{13}C_{12}$)dibenzo-*p*-dioxin	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	109719-83-7	100
Octachloro($^{13}C_{12}$)dibenzo-*p*-dioxin	$^{13}C_{12}$-OCDD	114423-97-1	200
Mass-Labelled PCDFs:			
2,3,7,8-Tetrachloro($^{13}C_{12}$)dibenzofuran	$^{13}C_{12}$-2,3,7,8-TCDF	89059-46-1	100
1,2,3,7,8-Pentachloro($^{13}C_{12}$)dibenzofuran	$^{13}C_{12}$-1,2,3,7,8-PeCDF	109719-77-9	100
2,3,4,7,8-Pentachloro($^{13}C_{12}$)dibenzofuran	$^{13}C_{12}$-2,3,4,7,8-PeCDF	116843-02-8	100
1,2,3,4,7,8-Hexachloro($^{13}C_{12}$)dibenzofuran	$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	114423-98-2	100
1,2,3,6,7,8-Hexachloro($^{13}C_{12}$)dibenzofuran	$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	116843-03-9	100
1,2,3,7,8,9-Hexachloro($^{13}C_{12}$)dibenzofuran	$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	116843-04-0	100
2,3,4,6,7,8-Hexachloro($^{13}C_{12}$)dibenzofuran	$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	116843-05-1	100
1,2,3,4,6,7,8-Heptachloro($^{13}C_{12}$)dibenzofuran	$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	109719-84-8	100
1,2,3,4,7,8,9-Heptachloro($^{13}C_{12}$)dibenzofuran	$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	109719-94-0	100

Certified By: _____ **Date:** 11/05/2021
(mm/dd/yyyy)
B.G. Chittim, General Manager

Figure 1: **EPA-1613LCS; HRGC/HRMS Data (60 m DB-5 Column)**

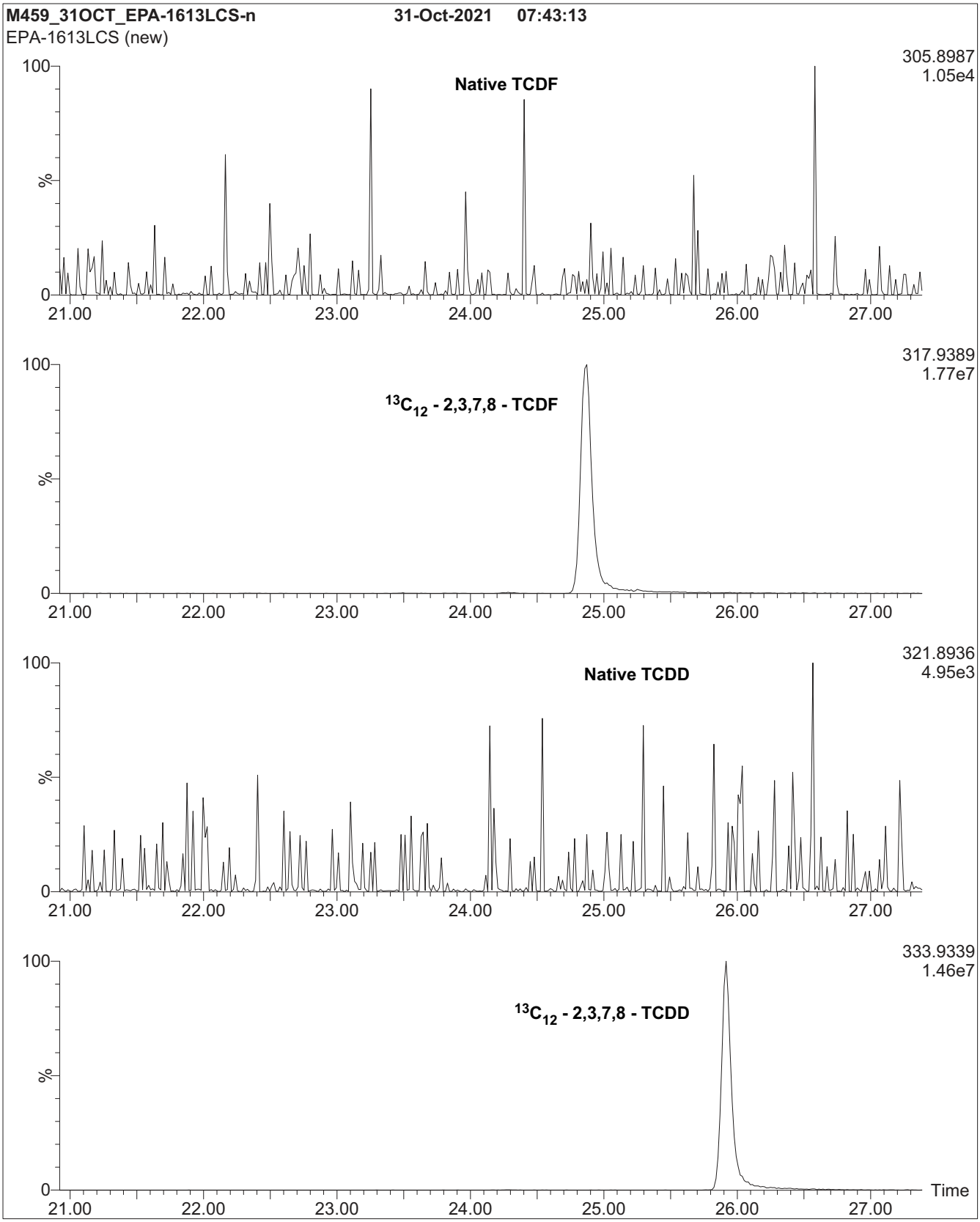


Figure 1: **EPA-1613LCS; HRGC/HRMS Data (60 m DB-5 Column)**

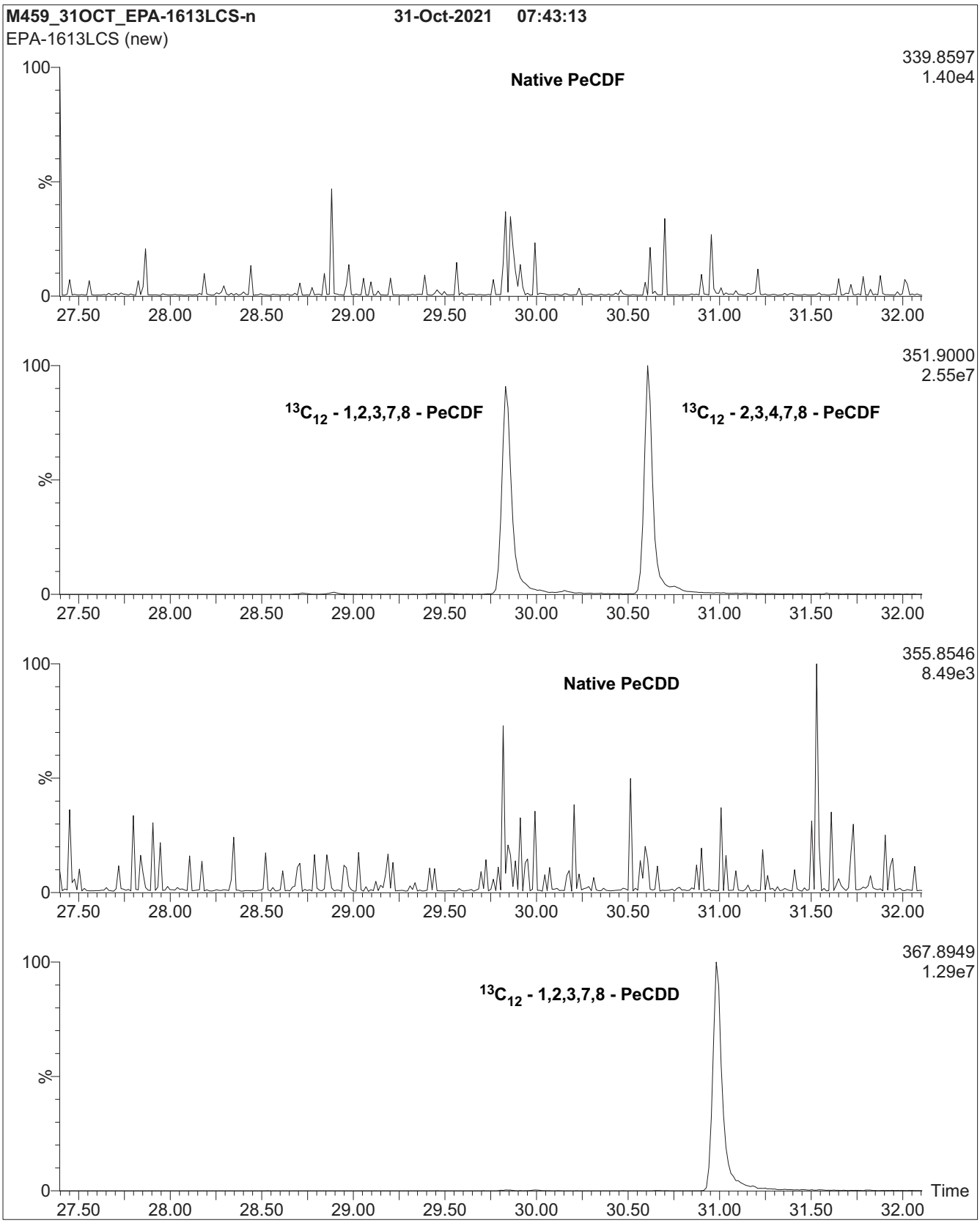


Figure 1: **EPA-1613LCS; HRGC/HRMS Data (60 m DB-5 Column)**

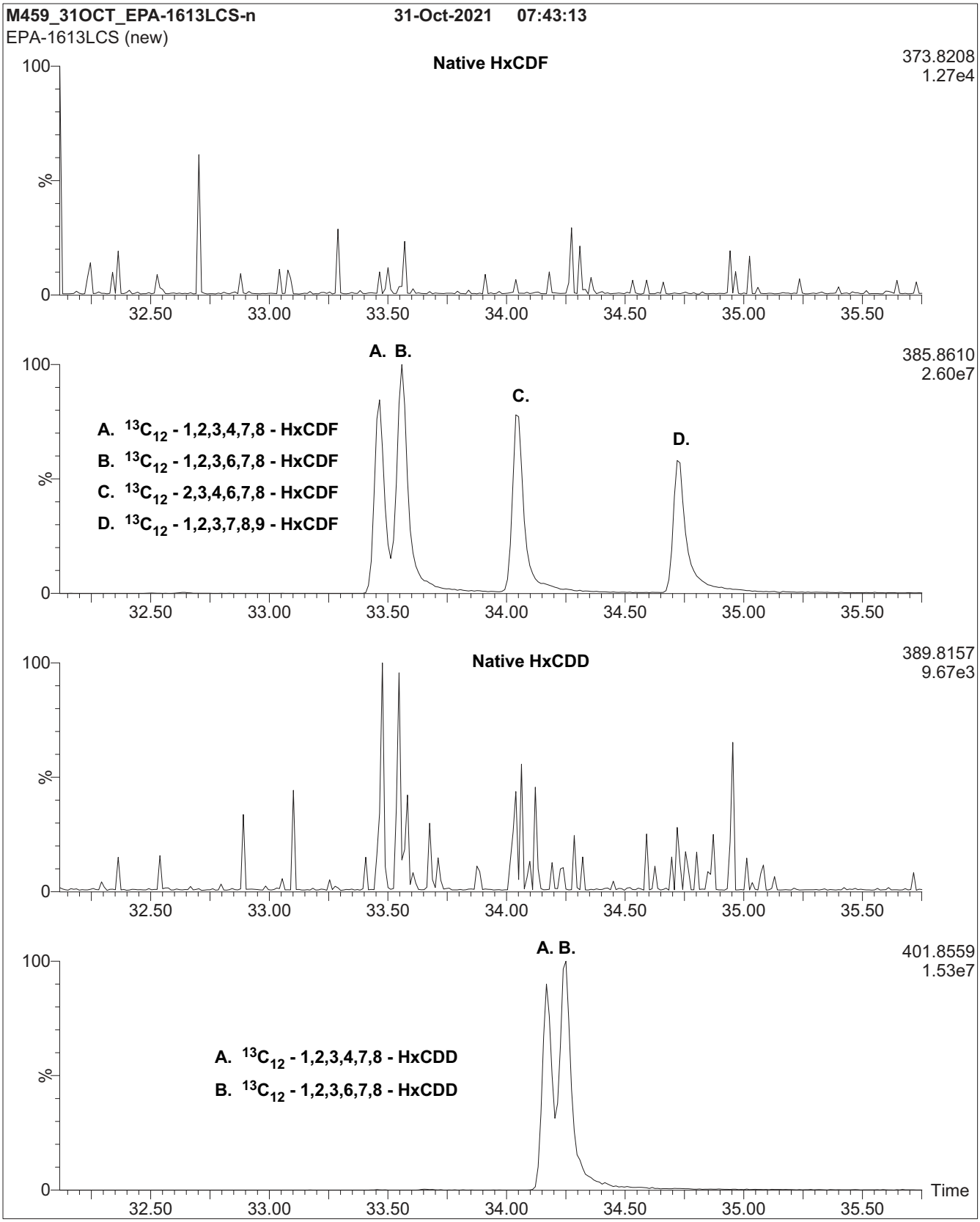


Figure 1: **EPA-1613LCS; HRGC/HRMS Data (60 m DB-5 Column)**

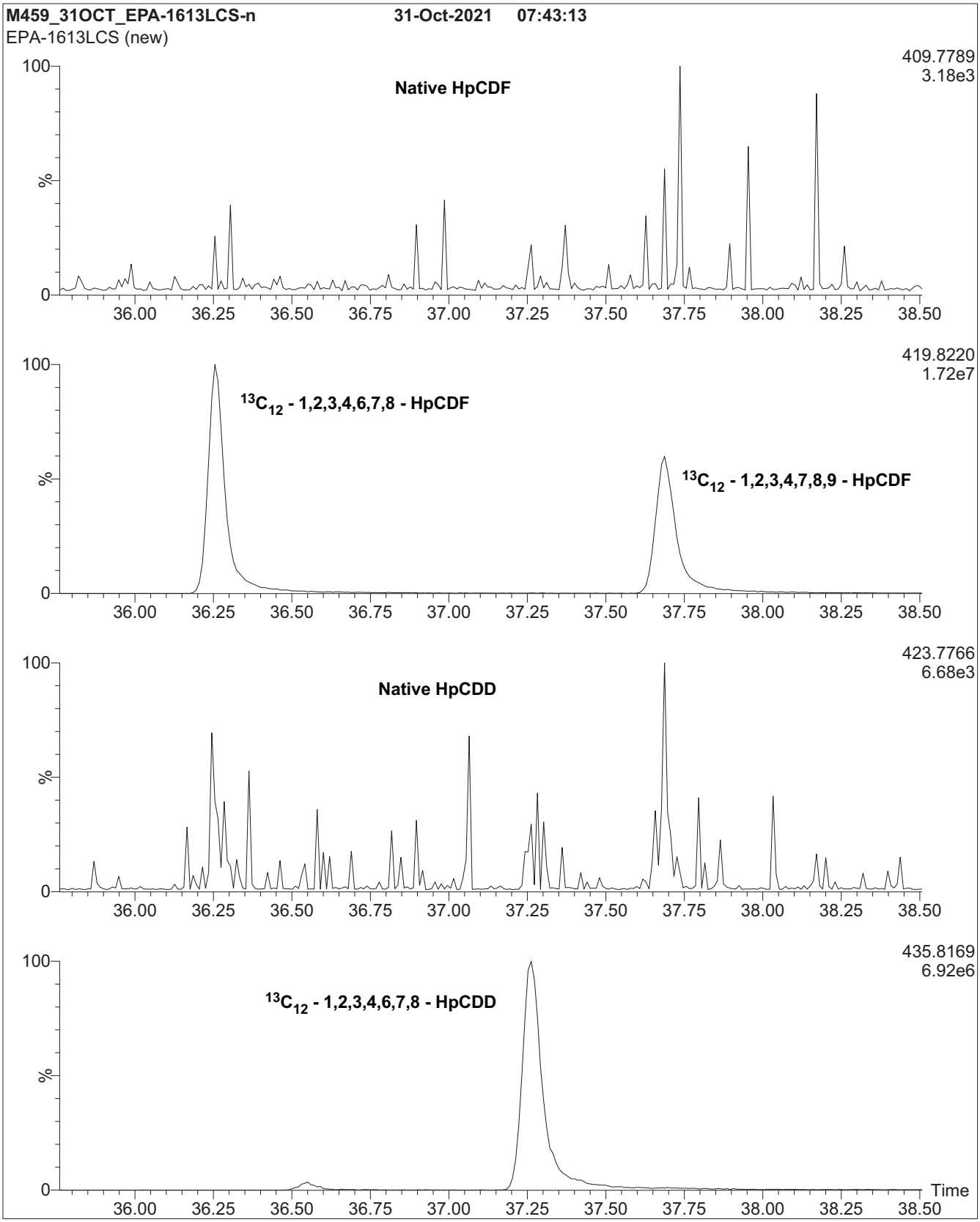
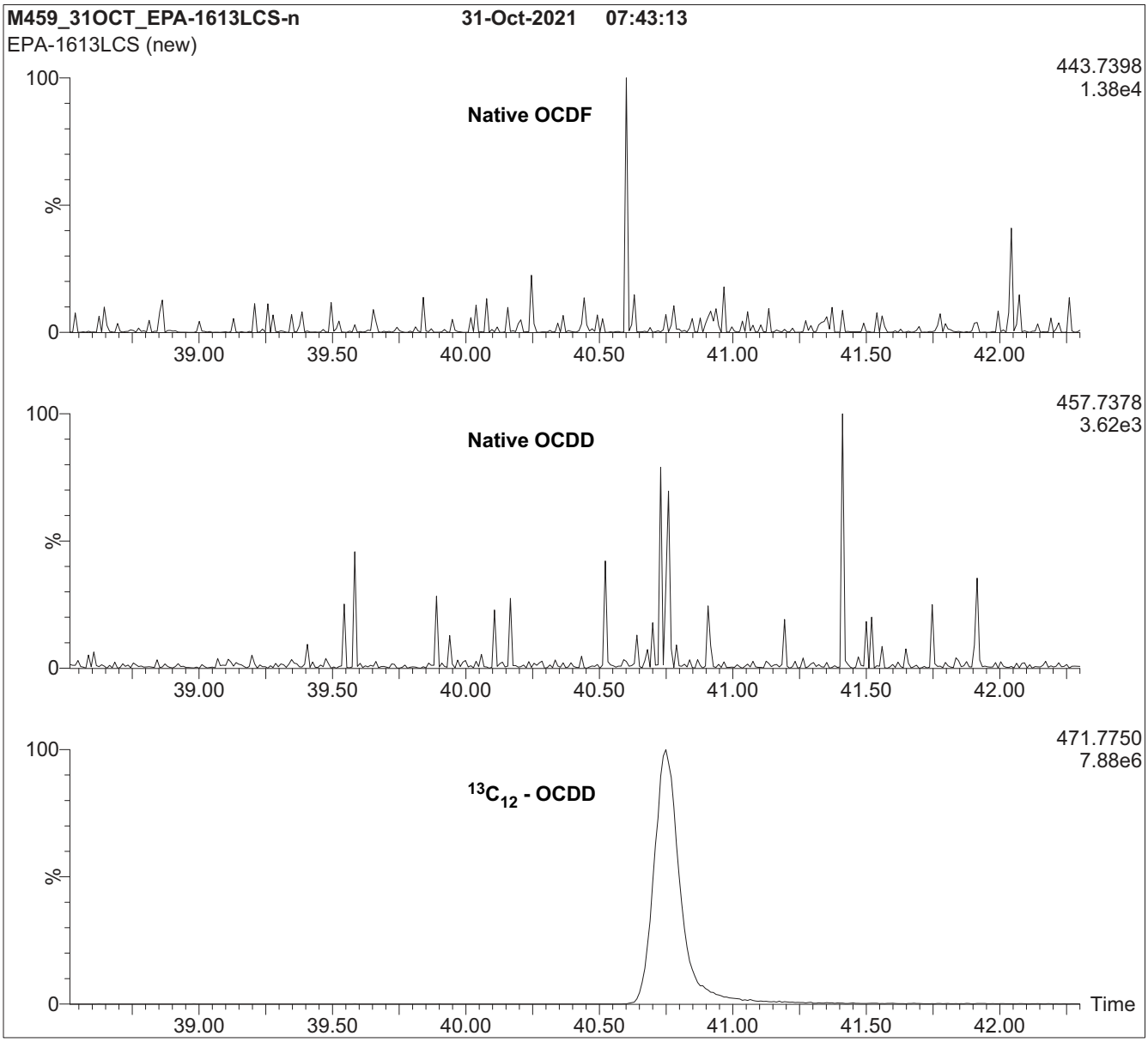


Figure 1: **EPA-1613LCS; HRGC/HRMS Data (60 m DB-5 Column)**



Conditions for Figure 1:

Agilent 6890N HRGC
Autospec Ultima HRMS

Chromatographic Conditions:

Column:	60 m DB-5 (0.25 mm id, 0.25 µm film thickness) Agilent J&W		
Flow:	Constant at 1.4 mL/min	Oven:	150°C (1 min)
Injector:	280°C (Splitless Injection)		12°C/min to 200°C
Ionization:	EI+		3°C/min to 235°C
Detector:	280°C		235°C (8 min)
	SIR at 10,000 mass resolving power		8°C/min to 310°C
			310°C (8 min)

Analytical Resources, LLC
Analytical Chemists and Consultants

Form I
INORGANIC ANALYSIS DATA SHEET
EPA 6020B

Dissolved Metals

MW-CP1-032322

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-01 A 01	SDG:	22C0456
Sampled:	03/23/22 14:26	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-083
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 22:43
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.551	1	0.0373	0.200	

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Analytical Chemists and Consultants

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EPA 6020B

Dissolved Metals

MW-CP1-032322-D

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-02 A 01	SDG:	22C0456
Sampled:	03/23/22 14:36	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-079
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 22:25
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.511	1	0.0373	0.200	

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Analytical Chemists and Consultants

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Dissolved Metals

MW-CP2-032322

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-03 A 01	SDG:	22C0456
Sampled:	03/23/22 13:26	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-080
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 22:28
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.327	1	0.0373	0.200	

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Dissolved Metals

MW-CP3-032322

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-04 A 01	SDG:	22C0456
Sampled:	03/23/22 13:25	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-081
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 22:36
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.968	1	0.0373	0.200	

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Dissolved Metals

MW-CP4-032322

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-05 A 01	SDG:	22C0456
Sampled:	03/23/22 12:06	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-082
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 22:39
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.0930	1	0.0373	0.200	J

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Analytical Chemists and Consultants

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EPA 6020B

Dissolved Metals

MW-CP5-032322

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-06 A 01	SDG:	22C0456
Sampled:	03/23/22 12:25	Prepared:	04/07/22 12:08	File ID:	XDT_m1220412-060
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/12/22 23:09
Batch:	BKD0201	Sequence:	SKD0163	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00036

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	3.73	1	0.0373	0.200	

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Dissolved Metals

MW-CP6-032322

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-07 A 01	SDG:	22C0456
Sampled:	03/23/22 11:15	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-090
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 23:12
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.852	1	0.0373	0.200	

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EPA 6020B

Dissolved Metals

MW-CP7-032322

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-08 A 01	SDG:	22C0456
Sampled:	03/23/22 11:06	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-091
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 23:16
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.366	1	0.0373	0.200	

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EPA 6020B

Dissolved Metals

MW-VB3-032322

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-09 A 01	SDG:	22C0456
Sampled:	03/23/22 09:36	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-092
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 23:19
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.381	1	0.0373	0.200	

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Analytical Chemists and Consultants

Form I
INORGANIC ANALYSIS DATA SHEET
EPA 6020B

Dissolved Metals

HCOO-B312-032322

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-10 A 01	SDG:	22C0456
Sampled:	03/23/22 15:00	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-093
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 23:23
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.170	1	0.0373	0.200	J

Analytical Resources, LLC
Analytical Chemists and Consultants

Form I
INORGANIC ANALYSIS DATA SHEET
EPA 6020B

Dissolved Metals

MW-C1-VB1-032422

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-11 A 01	SDG:	22C0456
Sampled:	03/24/22 12:33	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-094
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 23:27
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.0770	1	0.0373	0.200	J

Analytical Resources, LLC
Analytical Chemists and Consultants

Form I
INORGANIC ANALYSIS DATA SHEET
EPA 6020B

Dissolved Metals

MW-C1-VB1-032422-D

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-12 A 01	SDG:	22C0456
Sampled:	03/24/22 12:37	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-095
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 23:30
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.0900	1	0.0373	0.200	J

Analytical Resources, LLC
Analytical Chemists and Consultants

Form I
INORGANIC ANALYSIS DATA SHEET
EPA 6020B

Dissolved Metals

MW-C2-032422

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-13 A 01	SDG:	22C0456
Sampled:	03/24/22 11:36	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-096
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 23:34
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	24.0	1	0.0373	0.200	

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Form I
INORGANIC ANALYSIS DATA SHEET
EPA 6020B

Dissolved Metals

MW-C3-032422

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-14 A 01	SDG:	22C0456
Sampled:	03/24/22 11:33	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-097
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 23:38
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.194	1	0.0373	0.200	J

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Analytical Chemists and Consultants

Form I
INORGANIC ANALYSIS DATA SHEET
EPA 6020B

Dissolved Metals

MW-C1-VB2-032422

Laboratory:	Analytical Resources, LLC				
Client:	Floyd - Snider				
Project:	Lora Lake 2021-2023 sec II. 5.3.21				
Matrix:	Water	Laboratory ID:	22C0456-15 A 01	SDG:	22C0456
Sampled:	03/24/22 10:30	Prepared:	04/07/22 12:08	File ID:	XDT_m1220411-101
% Solids:	0.00	Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Analyzed:	04/11/22 23:57
Batch:	BKD0201	Sequence:	SKD0140	Initial/Final:	25 mL / 25 mL
Instrument:	ICPMS1			Calibration:	FD00031

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic, Dissolved	0.351	1	0.0373	0.200	

Analytical Resources, LLC
Analytical Chemists and Consultants

PREPARATION BATCH SUMMARY

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Batch: BKD0201 Batch Matrix: Water
Preparation: REN EPA 600/4-79-020 4.1.4 HNO3 matrix

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
MW-CP1-032322	22C0456-01	XDT_m1220411-083	04/07/22 12:08	
MW-CP1-032322-D	22C0456-02	XDT_m1220411-079	04/07/22 12:08	
MW-CP2-032322	22C0456-03	XDT_m1220411-080	04/07/22 12:08	
MW-CP3-032322	22C0456-04	XDT_m1220411-081	04/07/22 12:08	
MW-CP4-032322	22C0456-05	XDT_m1220411-082	04/07/22 12:08	
MW-CP5-032322	22C0456-06	XDT_m1220412-060	04/07/22 12:08	
MW-CP6-032322	22C0456-07	XDT_m1220411-090	04/07/22 12:08	
MW-CP7-032322	22C0456-08	XDT_m1220411-091	04/07/22 12:08	
MW-VB3-032322	22C0456-09	XDT_m1220411-092	04/07/22 12:08	
HCOO-B312-032322	22C0456-10	XDT_m1220411-093	04/07/22 12:08	
MW-C1-VB1-032422	22C0456-11	XDT_m1220411-094	04/07/22 12:08	
MW-C1-VB1-032422-D	22C0456-12	XDT_m1220411-095	04/07/22 12:08	
MW-C2-032422	22C0456-13	XDT_m1220411-096	04/07/22 12:08	
MW-C3-032422	22C0456-14	XDT_m1220411-097	04/07/22 12:08	
MW-C1-VB2-032422	22C0456-15	XDT_m1220411-101	04/07/22 12:08	
Blank	BKD0201-BLK1	XDT_m1220408-080	04/07/22 12:08	
LCS	BKD0201-BS1	XDT_m1220408-081	04/07/22 12:08	
MW-CP1-032322	BKD0201-DUP1	XDT_m1220411-084	04/07/22 12:08	
MW-CP1-032322	BKD0201-MS1	XDT_m1220411-085	04/07/22 12:08	

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Analytical Chemists and Consultants

Form I

METHOD BLANK DATA SHEET

EPA 6020B

Dissolved Metals

Blank

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Batch: BKD0201
Laboratory ID: BKD0201-BLK1
Prepared: 04/07/22 12:08
Matrix: Water
Preparation: REN EPA 600/4-79-020 4
Analyzed: 04/08/22 21:56
Sequence: SKD0126
Calibration: FD00028
Instrument: ICPMS1

CAS NO.	Analyte	Concentration (ug/L)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic-75a	ND	1	0.0373	0.200	U

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LCS / LCS DUPLICATE RECOVERY

EPA 6020B

Dissolved Metals

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Matrix:	Water	Analyzed:	04/08/22 22:01
Batch:	BKD0201	Laboratory ID:	BKD0201-BS1
Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Sequence Name:	LCS
Initial/Final:	25 mL / 25 mL		

COMPOUND	SPIKE ADDED (ug/L)	LCS CONCENTRATION (ug/L)	Q	LCS % REC. #	QC LIMITS REC.
Arsenic-75a (dissolved)	25.0	24.4		97.7	80 - 120

* Indicates values outside of QC limits

Analytical Resources, LLC
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MW-CP1-032322

DUPLICATES

EPA 6020B

Dissolved Metals

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Matrix: Water
Laboratory ID: BKD0201-DUP1
Batch: BKD0201
Lab Source ID: 22C0456-01
Preparation: REN EPA 600/4-79-020 4.1.4 HNO3 matrix
Initial/Final: 25 mL / 25 mL
Source Sample Name: MW-CP1-032322
% Solids:

ANALYTE	CONTROL LIMIT	SAMPLE CONCENTRATION	DUPLICATE CONCENTRATION	RPD %	Q
Arsenic-75a (dissolved)	20	0.551	0.500	9.71	

*: Values outside of QC limits
L: Analyte concentration is <=5 times the reporting limit and the replicate control limit defaults to Dup = +/- RL instead of 20% RPD

Analytical Resources, LLC
Analytical Chemists and Consultants

MW-CP1-032322

MS / MS DUPLICATE RECOVERY

EPA 6020B

Dissolved Metals

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Matrix:	Water	Analyzed:	04/11/22 22:50
Batch:	BKD0201	Laboratory ID:	BKD0201-MS1
Preparation:	REN EPA 600/4-79-020 4.1.4 HNO3 matrix	Sequence Name:	Matrix Spike
Initial/Final:	25 mL / 25 mL	Source Sample:	MW-CP1-032322

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	Q	MS CONCENTRATION (ug/L)	Q	MS % REC. #	QC LIMITS REC.
Arsenic-75a (dissolved)	25.0	0.551		26.7		105	75 - 125

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Calibration: FD00028
Instrument: ICPMS1
Calibration Date: 04/08/2022 15:11

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
	Conc	RF	Conc	RF	Conc	RF	Conc	RF	Conc	RF	Conc	RF
Arsenic-75a, Dissolved	0	0	0.2	175	10	178.6	20	177.55	50	173.62	100	176.01

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INITIAL CALIBRATION DATA

EPA 6020B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Calibration:	FD00028	Instrument:	ICPMS1
Calibration Date:	04/08/2022 15:11		

COMPOUND	Mean RF	RF RSD	Linear COD	Quad COD	COD Limit	Q
Arsenic-75a, Dissolved	146.7967	49.0	0.9999		0.998	

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INITIAL CALIBRATION DATA

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Calibration: FD00031
Instrument: ICPMS1
Calibration Date: 04/11/2022 15:20

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
	Conc	RF	Conc	RF	Conc	RF	Conc	RF	Conc	RF	Conc	RF
Arsenic-75a, Dissolved	0	0	0.2	175	10	179.4	20	179.45	50	178.1	100	174.45

Analytical Resources, LLC
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INITIAL CALIBRATION DATA

EPA 6020B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Calibration:	FD00031	Instrument:	ICPMS1
Calibration Date:	04/11/2022 15:20		

COMPOUND	Mean RF	RF RSD	Linear COD	Quad COD	COD Limit	Q
Arsenic-75a, Dissolved	147.7333	49.0	0.9999		0.998	

Analytical Resources, LLC
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INITIAL CALIBRATION DATA

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Calibration: FD00036
Instrument: ICPMS1
Calibration Date: 04/12/2022 17:01

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
	Conc	RF	Conc	RF	Conc	RF	Conc	RF	Conc	RF	Conc	RF
Arsenic-75a, Dissolved	0	0	0.2	130	10	124.4	20	125.9	50	124.5	100	129.83

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INITIAL CALIBRATION DATA

EPA 6020B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Calibration:	FD00036	Instrument:	ICPMS1
Calibration Date:	04/12/2022 17:01		

COMPOUND	Mean RF	RF RSD	Linear COD	Quad COD	COD Limit	Q
Arsenic-75a, Dissolved	105.7717	49.0	0.9996		0.998	

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INITIAL AND CONTINUING CALIBRATION CHECK

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00028
Control Limt: +/- 10.00%
Sequence: SKD0126

Lab Sample ID	Analyte	True	Found	%R	Units	Method
SKD0126-ICV1	Arsenic-75a (dissolved)	50.000	49.2	98.4	ug/L	EPA 6020B
SKD0126-CCV1	Arsenic-75a (dissolved)	50.000	49.2	98.4	ug/L	EPA 6020B
SKD0126-CCV2	Arsenic-75a (dissolved)	50.000	50.6	101	ug/L	EPA 6020B
SKD0126-CCV3	Arsenic-75a (dissolved)	50.000	49.3	98.6	ug/L	EPA 6020B
SKD0126-CCV4	Arsenic-75a (dissolved)	50.000	49.2	98.5	ug/L	EPA 6020B
SKD0126-CCV5	Arsenic-75a (dissolved)	50.000	49.6	99.2	ug/L	EPA 6020B
SKD0126-CCV6	Arsenic-75a (dissolved)	50.000	48.9	97.9	ug/L	EPA 6020B
SKD0126-CCV7	Arsenic-75a (dissolved)	50.000	49.6	99.1	ug/L	EPA 6020B
SKD0126-CCV8	Arsenic-75a (dissolved)	50.000	49.8	99.5	ug/L	EPA 6020B
SKD0126-CCV9	Arsenic-75a (dissolved)	50.000	49.7	99.4	ug/L	EPA 6020B
SKD0126-CCVA	Arsenic-75a (dissolved)	50.000	50.1	100	ug/L	EPA 6020B
SKD0126-CCVB	Arsenic-75a (dissolved)	50.000	49.4	98.9	ug/L	EPA 6020B
SKD0126-CCVC	Arsenic-75a (dissolved)	50.000	49.8	99.7	ug/L	EPA 6020B
SKD0126-CCVD	Arsenic-75a (dissolved)	50.000	49.9	99.7	ug/L	EPA 6020B
SKD0126-CCVE	Arsenic-75a (dissolved)	50.000	49.5	98.9	ug/L	EPA 6020B

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00031
Control Limt: +/- 10.00%
Sequence: SKD0140

Lab Sample ID	Analyte	True	Found	%R	Units	Method
SKD0140-ICV1	Arsenic-75a (dissolved)	50.000	52.1	104	ug/L	EPA 6020B
SKD0140-CCV1	Arsenic-75a (dissolved)	50.000	50.3	101	ug/L	EPA 6020B
SKD0140-CCV2	Arsenic-75a (dissolved)	50.000	50.6	101	ug/L	EPA 6020B
SKD0140-CCV3	Arsenic-75a (dissolved)	50.000	52.2	104	ug/L	EPA 6020B
SKD0140-CCV4	Arsenic-75a (dissolved)	50.000	50.2	100	ug/L	EPA 6020B
SKD0140-CCV5	Arsenic-75a (dissolved)	50.000	50.7	101	ug/L	EPA 6020B
SKD0140-CCV6	Arsenic-75a (dissolved)	50.000	51.4	103	ug/L	EPA 6020B
SKD0140-CCV7	Arsenic-75a (dissolved)	50.000	51.1	102	ug/L	EPA 6020B
SKD0140-CCV8	Arsenic-75a (dissolved)	50.000	52.3	105	ug/L	EPA 6020B
SKD0140-CCV9	Arsenic-75a (dissolved)	50.000	52.4	105	ug/L	EPA 6020B
SKD0140-CCVA	Arsenic-75a (dissolved)	50.000	51.8	104	ug/L	EPA 6020B
SKD0140-CCVB	Arsenic-75a (dissolved)	50.000	52.6	105	ug/L	EPA 6020B
SKD0140-CCVC	Arsenic-75a (dissolved)	50.000	52.1	104	ug/L	EPA 6020B
SKD0140-CCVD	Arsenic-75a (dissolved)	50.000	51.6	103	ug/L	EPA 6020B

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00036
Control Limt: +/- 10.00%
Sequence: SKD0163

Lab Sample ID	Analyte	True	Found	%R	Units	Method
SKD0163-ICV1	Arsenic-75a (dissolved)	50.000	48.3	96.6	ug/L	EPA 6020B
SKD0163-CCV1	Arsenic-75a (dissolved)	50.000	46.4	92.9	ug/L	EPA 6020B
SKD0163-CCV2	Arsenic-75a (dissolved)	50.000	49.9	99.8	ug/L	EPA 6020B
SKD0163-CCV3	Arsenic-75a (dissolved)	50.000	49.7	99.4	ug/L	EPA 6020B
SKD0163-CCV4	Arsenic-75a (dissolved)	50.000	47.5	94.9	ug/L	EPA 6020B
SKD0163-CCV5	Arsenic-75a (dissolved)	50.000	47.0	94.0	ug/L	EPA 6020B
SKD0163-CCV6	Arsenic-75a (dissolved)	50.000	49.2	98.4	ug/L	EPA 6020B
SKD0163-CCV7	Arsenic-75a (dissolved)	50.000	45.8	91.7	ug/L	EPA 6020B
SKD0163-CCV8	Arsenic-75a (dissolved)	50.000	46.6	93.2	ug/L	EPA 6020B
SKD0163-CCV9	Arsenic-75a (dissolved)	50.000	46.0	92.1	ug/L	EPA 6020B
SKD0163-CCVA	Arsenic-75a (dissolved)	50.000	46.1	92.3	ug/L	EPA 6020B
SKD0163-CCVB	Arsenic-75a (dissolved)	50.000	46.1	92.2	ug/L	EPA 6020B
SKD0163-CCVC	Arsenic-75a (dissolved)	50.000	45.4	90.7	ug/L	EPA 6020B
SKD0163-CCVD	Arsenic-75a (dissolved)	50.000	45.8	91.5	ug/L	EPA 6020B
SKD0163-CCVE	Arsenic-75a (dissolved)	50.000	45.6	91.2	ug/L	EPA 6020B
SKD0163-CCVF	Arsenic-75a (dissolved)	50.000	46.5	92.9	ug/L	EPA 6020B
SKD0163-CCVG	Arsenic-75a (dissolved)	50.000	46.1	92.2	ug/L	EPA 6020B
SKD0163-CCVH	Arsenic-75a (dissolved)	50.000	45.9	91.8	ug/L	EPA 6020B

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

INSTRUMENT BLANKS
EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00028
Sequence: SKD0126
Date Analyzed: 04/08/22 15:47

Lab Sample ID	Analyte	Found	MDL	MRL	Units	C
SKD0126-IBL1	Arsenic-75a (dissolved)	0.00400	0.0373	0.200	ug/L	
SKD0126-ICB1	Arsenic-75a (dissolved)	0.00400	0.0373	0.200	ug/L	
SKD0126-CCB1	Arsenic-75a (dissolved)	-0.00200	0.0373	0.200	ug/L	
SKD0126-IBL2	Arsenic-75a (dissolved)	0.331	0.0373	0.200	ug/L	
SKD0126-IBL3	Arsenic-75a (dissolved)	0.186	0.0373	0.200	ug/L	
SKD0126-CCB2	Arsenic-75a (dissolved)	0.152	0.0373	0.200	ug/L	
SKD0126-CCB3	Arsenic-75a (dissolved)	0.00500	0.0373	0.200	ug/L	
SKD0126-CCB4	Arsenic-75a (dissolved)	-0.0250	0.0373	0.200	ug/L	
SKD0126-IBL4	Arsenic-75a (dissolved)	-0.0280	0.0373	0.200	ug/L	
SKD0126-CCB5	Arsenic-75a (dissolved)	-0.0260	0.0373	0.200	ug/L	
SKD0126-CCB6	Arsenic-75a (dissolved)	-0.00300	0.0373	0.200	ug/L	
SKD0126-IBL5	Arsenic-75a (dissolved)	-0.00400	0.0373	0.200	ug/L	
SKD0126-CCB7	Arsenic-75a (dissolved)	-0.00600	0.0373	0.200	ug/L	
SKD0126-IBL6	Arsenic-75a (dissolved)	-0.00200	0.0373	0.200	ug/L	
SKD0126-IBL7	Arsenic-75a (dissolved)	-0.00500	0.0373	0.200	ug/L	
SKD0126-CCB8	Arsenic-75a (dissolved)	0.00200	0.0373	0.200	ug/L	
SKD0126-IBL8	Arsenic-75a (dissolved)	-0.00100	0.0373	0.200	ug/L	
SKD0126-CCB9	Arsenic-75a (dissolved)	0.00200	0.0373	0.200	ug/L	
SKD0126-CCBA	Arsenic-75a (dissolved)	-0.00400	0.0373	0.200	ug/L	
SKD0126-IBL9	Arsenic-75a (dissolved)	0.0120	0.0373	0.200	ug/L	
SKD0126-CCBB	Arsenic-75a (dissolved)	-0.00700	0.0373	0.200	ug/L	
SKD0126-IBLA	Arsenic-75a (dissolved)	-0.00200	0.0373	0.200	ug/L	
SKD0126-CCBC	Arsenic-75a (dissolved)	0.00100	0.0373	0.200	ug/L	
SKD0126-IBLB	Arsenic-75a (dissolved)	0.00200	0.0373	0.200	ug/L	
SKD0126-CCBD	Arsenic-75a (dissolved)	0.00900	0.0373	0.200	ug/L	
SKD0126-IBLC	Arsenic-75a (dissolved)	-0.00200	0.0373	0.200	ug/L	
SKD0126-CCBE	Arsenic-75a (dissolved)	0.0380	0.0373	0.200	ug/L	

Analytical Resources, LLC
Analytical Chemists and Consultants

INSTRUMENT BLANKS
EPA 6020B

Laboratory: Analytical Resources, LLC
Client: Floyd - Snider
Instrument ID: ICPMS1
Sequence: SKD0140

SDG: 22C0456
Project: Lora Lake 2021-2023 sec II. 5.3.21
Calibration: FD00031
Date Analyzed: 04/11/22 15:56

Lab Sample ID	Analyte	Found	MDL	MRL	Units	C
SKD0140-IBL1	Arsenic-75a (dissolved)	0.0100	0.0373	0.200	ug/L	
SKD0140-ICB1	Arsenic-75a (dissolved)	0.00800	0.0373	0.200	ug/L	
SKD0140-CCB1	Arsenic-75a (dissolved)	0.00700	0.0373	0.200	ug/L	
SKD0140-IBL2	Arsenic-75a (dissolved)	0.0220	0.0373	0.200	ug/L	
SKD0140-IBL3	Arsenic-75a (dissolved)	0.00500	0.0373	0.200	ug/L	
SKD0140-CCB2	Arsenic-75a (dissolved)	0.00800	0.0373	0.200	ug/L	
SKD0140-CCB3	Arsenic-75a (dissolved)	0.0100	0.0373	0.200	ug/L	
SKD0140-IBL4	Arsenic-75a (dissolved)	0.00	0.0373	0.200	ug/L	
SKD0140-CCB4	Arsenic-75a (dissolved)	0.00300	0.0373	0.200	ug/L	
SKD0140-IBL5	Arsenic-75a (dissolved)	0.00100	0.0373	0.200	ug/L	
SKD0140-CCB5	Arsenic-75a (dissolved)	0.00800	0.0373	0.200	ug/L	
SKD0140-CCB6	Arsenic-75a (dissolved)	0.00	0.0373	0.200	ug/L	
SKD0140-IBL6	Arsenic-75a (dissolved)	0.00500	0.0373	0.200	ug/L	
SKD0140-IBL7	Arsenic-75a (dissolved)	0.00500	0.0373	0.200	ug/L	
SKD0140-CCB7	Arsenic-75a (dissolved)	0.00700	0.0373	0.200	ug/L	
SKD0140-CCB8	Arsenic-75a (dissolved)	0.00	0.0373	0.200	ug/L	
SKD0140-IBL8	Arsenic-75a (dissolved)	-0.00300	0.0373	0.200	ug/L	
SKD0140-CCB9	Arsenic-75a (dissolved)	0.00400	0.0373	0.200	ug/L	
SKD0140-IBL9	Arsenic-75a (dissolved)	-0.0100	0.0373	0.200	ug/L	
SKD0140-CCBA	Arsenic-75a (dissolved)	-0.00500	0.0373	0.200	ug/L	
SKD0140-IBLA	Arsenic-75a (dissolved)	-0.0120	0.0373	0.200	ug/L	
SKD0140-CCBB	Arsenic-75a (dissolved)	0.00300	0.0373	0.200	ug/L	
SKD0140-IBLB	Arsenic-75a (dissolved)	-0.00900	0.0373	0.200	ug/L	
SKD0140-CCBC	Arsenic-75a (dissolved)	-0.00200	0.0373	0.200	ug/L	
SKD0140-IBLC	Arsenic-75a (dissolved)	-0.00500	0.0373	0.200	ug/L	
SKD0140-CCBD	Arsenic-75a (dissolved)	0.00500	0.0373	0.200	ug/L	

Analytical Resources, LLC
Analytical Chemists and Consultants

INSTRUMENT BLANKS
EPA 6020B

Laboratory: Analytical Resources, LLC
Client: Floyd - Snider
Instrument ID: ICPMS1
Sequence: SKD0163

SDG: 22C0456
Project: Lora Lake 2021-2023 sec II. 5.3.21
Calibration: FD00036
Date Analyzed: 04/12/22 17:38

Lab Sample ID	Analyte	Found	MDL	MRL	Units	C
SKD0163-IBL1	Arsenic-75a (dissolved)	0.00400	0.0373	0.200	ug/L	
SKD0163-ICB1	Arsenic-75a (dissolved)	0.00700	0.0373	0.200	ug/L	
SKD0163-CCB1	Arsenic-75a (dissolved)	-0.00700	0.0373	0.200	ug/L	
SKD0163-IBL2	Arsenic-75a (dissolved)	0.0420	0.0373	0.200	ug/L	
SKD0163-IBL3	Arsenic-75a (dissolved)	-0.00500	0.0373	0.200	ug/L	
SKD0163-CCB2	Arsenic-75a (dissolved)	-0.00100	0.0373	0.200	ug/L	
SKD0163-IBL4	Arsenic-75a (dissolved)	-0.0100	0.0373	0.200	ug/L	
SKD0163-IBL5	Arsenic-75a (dissolved)	-0.0100	0.0373	0.200	ug/L	
SKD0163-CCB3	Arsenic-75a (dissolved)	-0.00100	0.0373	0.200	ug/L	
SKD0163-CCB4	Arsenic-75a (dissolved)	0.00200	0.0373	0.200	ug/L	
SKD0163-IBL6	Arsenic-75a (dissolved)	-0.00100	0.0373	0.200	ug/L	
SKD0163-CCB5	Arsenic-75a (dissolved)	0.0150	0.0373	0.200	ug/L	
SKD0163-IBL7	Arsenic-75a (dissolved)	-0.00500	0.0373	0.200	ug/L	
SKD0163-CCB6	Arsenic-75a (dissolved)	-0.00100	0.0373	0.200	ug/L	
SKD0163-IBL8	Arsenic-75a (dissolved)	0.00200	0.0373	0.200	ug/L	
SKD0163-IBL9	Arsenic-75a (dissolved)	-0.00300	0.0373	0.200	ug/L	
SKD0163-CCB7	Arsenic-75a (dissolved)	-0.00400	0.0373	0.200	ug/L	
SKD0163-IBLA	Arsenic-75a (dissolved)	0.00200	0.0373	0.200	ug/L	
SKD0163-CCB8	Arsenic-75a (dissolved)	0.0130	0.0373	0.200	ug/L	
SKD0163-CCB9	Arsenic-75a (dissolved)	0.00600	0.0373	0.200	ug/L	
SKD0163-IBLB	Arsenic-75a (dissolved)	-0.00100	0.0373	0.200	ug/L	
SKD0163-CCBA	Arsenic-75a (dissolved)	0.00	0.0373	0.200	ug/L	
SKD0163-IBLC	Arsenic-75a (dissolved)	0.00300	0.0373	0.200	ug/L	
SKD0163-CCBB	Arsenic-75a (dissolved)	0.00300	0.0373	0.200	ug/L	
SKD0163-IBLD	Arsenic-75a (dissolved)	0.0180	0.0373	0.200	ug/L	
SKD0163-CCBC	Arsenic-75a (dissolved)	0.00900	0.0373	0.200	ug/L	
SKD0163-IBLE	Arsenic-75a (dissolved)	0.00100	0.0373	0.200	ug/L	
SKD0163-CCBD	Arsenic-75a (dissolved)	0.00500	0.0373	0.200	ug/L	
SKD0163-CCBE	Arsenic-75a (dissolved)	0.00300	0.0373	0.200	ug/L	
SKD0163-IBLF	Arsenic-75a (dissolved)	0.0220	0.0373	0.200	ug/L	
SKD0163-CCBF	Arsenic-75a (dissolved)	0.0100	0.0373	0.200	ug/L	
SKD0163-IBLG	Arsenic-75a (dissolved)	0.0120	0.0373	0.200	ug/L	
SKD0163-CCBG	Arsenic-75a (dissolved)	0.0140	0.0373	0.200	ug/L	
SKD0163-IBLH	Arsenic-75a (dissolved)	0.0110	0.0373	0.200	ug/L	
SKD0163-CCBH	Arsenic-75a (dissolved)	0.0230	0.0373	0.200	ug/L	

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6020B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0126	Instrument:	ICPMS1
		Calibration:	FD00028

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
CAL 0	SKD0126-CAL1	XDT_m1220408-014	NA	04/08/22 15:11
CAL 1 - LOW CHECK	SKD0126-CAL2	XDT_m1220408-015	NA	04/08/22 15:16
CAL 2	SKD0126-CAL3	XDT_m1220408-016	NA	04/08/22 15:21
CAL 3	SKD0126-CAL4	XDT_m1220408-017	NA	04/08/22 15:27
CAL 4	SKD0126-CAL5	XDT_m1220408-018	NA	04/08/22 15:32
CAL 5	SKD0126-CAL6	XDT_m1220408-019	NA	04/08/22 15:39
RINSE	SKD0126-IBL1	XDT_m1220408-020	NA	04/08/22 15:47
Initial Cal Check	SKD0126-ICV1	XDT_m1220408-022	NA	04/08/22 15:54
Initial Cal Blank	SKD0126-ICB1	XDT_m1220408-023	NA	04/08/22 16:05
Calibration Check	SKD0126-CCV1	XDT_m1220408-024	NA	04/08/22 16:10
Calibration Blank	SKD0126-CCB1	XDT_m1220408-025	NA	04/08/22 16:18
Instrument RL Check	SKD0126-CRL1	XDT_m1220408-026	NA	04/08/22 16:24
Interference Check A	SKD0126-IFA1	XDT_m1220408-027	NA	04/08/22 16:29
Interference Check B	SKD0126-IFB1	XDT_m1220408-028	NA	04/08/22 16:34
LR300	SKD0126-HCV2	XDT_m1220408-030	NA	04/08/22 16:45
LR200	SKD0126-HCV1	XDT_m1220408-031	NA	04/08/22 16:53
Instrument Blank	SKD0126-IBL2	XDT_m1220408-032	NA	04/08/22 16:59
Instrument Blank	SKD0126-IBL3	XDT_m1220408-033	NA	04/08/22 17:06
Calibration Check	SKD0126-CCV2	XDT_m1220408-034	NA	04/08/22 17:13
Calibration Blank	SKD0126-CCB2	XDT_m1220408-035	NA	04/08/22 17:21
Calibration Check	SKD0126-CCV3	XDT_m1220408-037	NA	04/08/22 17:37
Calibration Blank	SKD0126-CCB3	XDT_m1220408-038	NA	04/08/22 17:45
ZZZZZ	22C0483-01	XDT_m1220408_PRE-042	Solid	04/08/22 18:14
ZZZZZ	22C0358-01	XDT_m1220408_PRE-043	Solid	04/08/22 18:19
ZZZZZ	22C0536-01	XDT_m1220408_PRE-046	Solid	04/08/22 18:34
Calibration Check	SKD0126-CCV4	XDT_m1220408-049	NA	04/08/22 18:51
Calibration Blank	SKD0126-CCB4	XDT_m1220408-050	NA	04/08/22 18:59
ZZZZZ	22C0313-01	XDT_m1220408_PRE-053	Solid	04/08/22 19:17
ZZZZZ	22C0313-01	XDT_m1220408_PRE-053	Solid	04/08/22 19:17

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Sequence: SKD0126
Instrument: ICPMS1
Calibration: FD00028

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
ZZZZZ	22C0314-01	XDT_m1220408_PRE-056	Solid	04/08/22 19:33
Instrument Blank	SKD0126-IBL4	XDT_m1220408-060	NA	04/08/22 19:54
Calibration Check	SKD0126-CCV5	XDT_m1220408-061	NA	04/08/22 19:59
Calibration Blank	SKD0126-CCB5	XDT_m1220408-062	NA	04/08/22 20:07
Calibration Check	SKD0126-CCV6	XDT_m1220408-064	NA	04/08/22 20:19
Calibration Blank	SKD0126-CCB6	XDT_m1220408-065	NA	04/08/22 20:27
ZZZZZ	22D0005-02	XDT_m1220408_PRE-070	Solid	04/08/22 20:57
ZZZZZ	22D0005-01	XDT_m1220408_PRE-071	Solid	04/08/22 21:03
ZZZZZ	22D0022-01	XDT_m1220408-072	Solid	04/08/22 21:09
Instrument Blank	SKD0126-IBL5	XDT_m1220408-075	NA	04/08/22 21:26
Calibration Check	SKD0126-CCV7	XDT_m1220408-076	NA	04/08/22 21:31
Calibration Blank	SKD0126-CCB7	XDT_m1220408-077	NA	04/08/22 21:39
ZZZZZ	BKD0163-BLK1	XDT_m1220408-078	Water	04/08/22 21:46
ZZZZZ	BKD0163-BS1	XDT_m1220408-079	Water	04/08/22 21:51
Blank	BKD0201-BLK1	XDT_m1220408-080	Water	04/08/22 21:56
LCS	BKD0201-BS1	XDT_m1220408-081	Water	04/08/22 22:01
Instrument Blank	SKD0126-IBL6	XDT_m1220408-084	NA	04/08/22 22:19
Instrument Blank	SKD0126-IBL7	XDT_m1220408-087	NA	04/08/22 22:36
Calibration Check	SKD0126-CCV8	XDT_m1220408-088	NA	04/08/22 22:41
Calibration Blank	SKD0126-CCB8	XDT_m1220408-089	NA	04/08/22 22:49
Instrument Blank	SKD0126-IBL8	XDT_m1220408-099	NA	04/08/22 23:46
Calibration Check	SKD0126-CCV9	XDT_m1220408-100	NA	04/08/22 23:51
Calibration Blank	SKD0126-CCB9	XDT_m1220408-101	NA	04/08/22 23:59
Calibration Check	SKD0126-CCVA	XDT_m1220408-103	NA	04/09/22 00:10
Calibration Blank	SKD0126-CCBA	XDT_m1220408-104	NA	04/09/22 00:18
ZZZZZ	BKD0202-BLK2	XDT_m1220408-105	Water	04/09/22 00:23
ZZZZZ	BKD0202-BS2	XDT_m1220408-106	Water	04/09/22 00:28
Instrument Blank	SKD0126-IBL9	XDT_m1220408-114	NA	04/09/22 01:15
Calibration Check	SKD0126-CCVB	XDT_m1220408-115	NA	04/09/22 01:20

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Sequence: SKD0126
Instrument: ICPMS1
Calibration: FD00028

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
Calibration Blank	SKD0126-CCBB	XDT_m1220408-116	NA	04/09/22 01:28
Instrument Blank	SKD0126-IBLA	XDT_m1220408-126	NA	04/09/22 02:25
Calibration Check	SKD0126-CCVC	XDT_m1220408-127	NA	04/09/22 02:31
Calibration Blank	SKD0126-CCBC	XDT_m1220408-128	NA	04/09/22 02:39
ZZZZZ	22C0372-06	XDT_m1220408-131	Water	04/09/22 02:54
ZZZZZ	22C0372-06	XDT_m1220408-131	Water	04/09/22 02:54
ZZZZZ	22C0372-06	XDT_m1220408-131	Water	04/09/22 02:54
ZZZZZ	22C0372-06	XDT_m1220408-131	Water	04/09/22 02:54
ZZZZZ	22C0372-06	XDT_m1220408-131	Water	04/09/22 02:54
ZZZZZ	22C0372-04	XDT_m1220408-132	Water	04/09/22 03:00
ZZZZZ	22C0372-04	XDT_m1220408-132	Water	04/09/22 03:00
ZZZZZ	22C0372-04	XDT_m1220408-132	Water	04/09/22 03:00
ZZZZZ	22C0372-04	XDT_m1220408-132	Water	04/09/22 03:00
ZZZZZ	22C0372-08	XDT_m1220408-133	Water	04/09/22 03:05
ZZZZZ	22C0372-08	XDT_m1220408-133	Water	04/09/22 03:05
ZZZZZ	22C0372-08	XDT_m1220408-133	Water	04/09/22 03:05
ZZZZZ	22C0372-08	XDT_m1220408-133	Water	04/09/22 03:05
ZZZZZ	22C0372-02	XDT_m1220408-134	Water	04/09/22 03:10
ZZZZZ	22C0372-02	XDT_m1220408-134	Water	04/09/22 03:10
ZZZZZ	22C0372-02	XDT_m1220408-134	Water	04/09/22 03:10
ZZZZZ	22C0372-02	XDT_m1220408-134	Water	04/09/22 03:10
ZZZZZ	22C0372-02	XDT_m1220408-134	Water	04/09/22 03:10
Instrument Blank	SKD0126-IBLB	XDT_m1220408-138	NA	04/09/22 03:36
Calibration Check	SKD0126-CCVD	XDT_m1220408-139	NA	04/09/22 03:41
Calibration Blank	SKD0126-CCBD	XDT_m1220408-140	NA	04/09/22 03:49
ZZZZZ	22C0403-02	XDT_m1220408-146	Water	04/09/22 04:23
ZZZZZ	22C0403-02	XDT_m1220408-146	Water	04/09/22 04:23
Instrument Blank	SKD0126-IBLC	XDT_m1220408-150	NA	04/09/22 04:49
Calibration Check	SKD0126-CCVE	XDT_m1220408-151	NA	04/09/22 04:54

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6020B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0126	Instrument:	ICPMS1
		Calibration:	FD00028

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
Calibration Blank	SKD0126-CCBE	XDT_m1220408-152	NA	04/09/22 05:02

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6020B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0140	Instrument:	ICPMS1
		Calibration:	FD00031

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
CAL 0	SKD0140-CAL1	XDT_m1220411-011	NA	04/11/22 15:20
CAL 1 - LOW CHECK	SKD0140-CAL2	XDT_m1220411-012	NA	04/11/22 15:25
CAL 2	SKD0140-CAL3	XDT_m1220411-013	NA	04/11/22 15:30
CAL 3	SKD0140-CAL4	XDT_m1220411-014	NA	04/11/22 15:35
CAL 4	SKD0140-CAL5	XDT_m1220411-015	NA	04/11/22 15:41
CAL 5	SKD0140-CAL6	XDT_m1220411-016	NA	04/11/22 15:48
RINSE	SKD0140-IBL1	XDT_m1220411-017	NA	04/11/22 15:56
Initial Cal Check	SKD0140-ICV1	XDT_m1220411-019	NA	04/11/22 16:03
Initial Cal Blank	SKD0140-ICB1	XDT_m1220411-020	NA	04/11/22 16:11
Calibration Check	SKD0140-CCV1	XDT_m1220411-021	NA	04/11/22 16:18
Calibration Blank	SKD0140-CCB1	XDT_m1220411-022	NA	04/11/22 16:26
Instrument RL Check	SKD0140-CRL1	XDT_m1220411-023	NA	04/11/22 16:32
Interference Check A	SKD0140-IFA1	XDT_m1220411-024	NA	04/11/22 16:37
Interference Check B	SKD0140-IFB1	XDT_m1220411-025	NA	04/11/22 16:42
LR200	SKD0140-HCV1	XDT_m1220411-026	NA	04/11/22 16:48
LR300	SKD0140-HCV2	XDT_m1220411-027	NA	04/11/22 16:53
Instrument Blank	SKD0140-IBL2	XDT_m1220411-028	NA	04/11/22 17:01
Instrument Blank	SKD0140-IBL3	XDT_m1220411-029	NA	04/11/22 17:08
Calibration Check	SKD0140-CCV2	XDT_m1220411-030	NA	04/11/22 17:16
Calibration Blank	SKD0140-CCB2	XDT_m1220411-031	NA	04/11/22 17:24
Calibration Check	SKD0140-CCV3	XDT_m1220411-033	NA	04/11/22 17:36
Calibration Blank	SKD0140-CCB3	XDT_m1220411-034	NA	04/11/22 17:44
Instrument Blank	SKD0140-IBL4	XDT_m1220411-044	NA	04/11/22 18:51
Calibration Check	SKD0140-CCV4	XDT_m1220411-045	NA	04/11/22 18:56
Calibration Blank	SKD0140-CCB4	XDT_m1220411-046	NA	04/11/22 19:04
ZZZZZ	22D0114-01	XDT_m1220411-050	Solid	04/11/22 19:26
Instrument Blank	SKD0140-IBL5	XDT_m1220411-056	NA	04/11/22 20:02
Calibration Check	SKD0140-CCV5	XDT_m1220411-057	NA	04/11/22 20:07
Calibration Blank	SKD0140-CCB5	XDT_m1220411-058	NA	04/11/22 20:15

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6020B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0140	Instrument:	ICPMS1
		Calibration:	FD00031

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
Calibration Check	SKD0140-CCV6	XDT_m1220411-060	NA	04/11/22 20:27
Calibration Blank	SKD0140-CCB6	XDT_m1220411-061	NA	04/11/22 20:36
Instrument Blank	SKD0140-IBL6	XDT_m1220411-066	NA	04/11/22 21:05
Instrument Blank	SKD0140-IBL7	XDT_m1220411-071	NA	04/11/22 21:39
Calibration Check	SKD0140-CCV7	XDT_m1220411-072	NA	04/11/22 21:44
Calibration Blank	SKD0140-CCB7	XDT_m1220411-073	NA	04/11/22 21:52
Calibration Check	SKD0140-CCV8	XDT_m1220411-075	NA	04/11/22 22:04
Calibration Blank	SKD0140-CCB8	XDT_m1220411-076	NA	04/11/22 22:10
MW-CP1-032322-D	22C0456-02	XDT_m1220411-079	Water	04/11/22 22:25
MW-CP2-032322	22C0456-03	XDT_m1220411-080	Water	04/11/22 22:28
MW-CP3-032322	22C0456-04	XDT_m1220411-081	Water	04/11/22 22:36
MW-CP4-032322	22C0456-05	XDT_m1220411-082	Water	04/11/22 22:39
MW-CP1-032322	22C0456-01	XDT_m1220411-083	Water	04/11/22 22:43
MW-CP1-032322	BKD0201-DUP1	XDT_m1220411-084	Water	04/11/22 22:46
MW-CP1-032322	BKD0201-MS1	XDT_m1220411-085	Water	04/11/22 22:50
Instrument Blank	SKD0140-IBL8	XDT_m1220411-086	NA	04/11/22 22:55
Calibration Check	SKD0140-CCV9	XDT_m1220411-087	NA	04/11/22 22:59
Calibration Blank	SKD0140-CCB9	XDT_m1220411-088	NA	04/11/22 23:05
MW-CP6-032322	22C0456-07	XDT_m1220411-090	Water	04/11/22 23:12
MW-CP7-032322	22C0456-08	XDT_m1220411-091	Water	04/11/22 23:16
MW-VB3-032322	22C0456-09	XDT_m1220411-092	Water	04/11/22 23:19
HCOO-B312-032322	22C0456-10	XDT_m1220411-093	Water	04/11/22 23:23
MW-C1-VB1-032422	22C0456-11	XDT_m1220411-094	Water	04/11/22 23:27
MW-C1-VB1-032422-D	22C0456-12	XDT_m1220411-095	Water	04/11/22 23:30
MW-C2-032422	22C0456-13	XDT_m1220411-096	Water	04/11/22 23:34
MW-C3-032422	22C0456-14	XDT_m1220411-097	Water	04/11/22 23:38
Instrument Blank	SKD0140-IBL9	XDT_m1220411-098	NA	04/11/22 23:43
Calibration Check	SKD0140-CCVA	XDT_m1220411-099	NA	04/11/22 23:47
Calibration Blank	SKD0140-CCBA	XDT_m1220411-100	NA	04/11/22 23:53

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6020B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0140	Instrument:	ICPMS1
		Calibration:	FD00031

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
MW-C1-VB2-032422	22C0456-15	XDT_m1220411-101	Water	04/11/22 23:57
Instrument Blank	SKD0140-IBLA	XDT_m1220411-110	NA	04/12/22 00:31
Calibration Check	SKD0140-CCVB	XDT_m1220411-111	NA	04/12/22 00:34
Calibration Blank	SKD0140-CCBB	XDT_m1220411-112	NA	04/12/22 00:41
Instrument Blank	SKD0140-IBLB	XDT_m1220411-122	NA	04/12/22 01:19
Calibration Check	SKD0140-CCVC	XDT_m1220411-123	NA	04/12/22 01:22
Calibration Blank	SKD0140-CCBC	XDT_m1220411-124	NA	04/12/22 01:29
ZZZZZ	BKD0293-BLK1	XDT_m1220411-125	Water	04/12/22 01:32
ZZZZZ	BKD0293-BS1	XDT_m1220411-126	Water	04/12/22 01:36
Instrument Blank	SKD0140-IBLC	XDT_m1220411-133	NA	04/12/22 02:03
Calibration Check	SKD0140-CCVD	XDT_m1220411-134	NA	04/12/22 02:07
Calibration Blank	SKD0140-CCBD	XDT_m1220411-135	NA	04/12/22 02:13

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6020B

Laboratory:	Analytical Resources, LLC	SDG:	22C0456
Client:	Floyd - Snider	Project:	Lora Lake 2021-2023 sec II. 5.3.21
Sequence:	SKD0163	Instrument:	ICPMS1
		Calibration:	FD00036

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
CAL 0	SKD0163-CAL1	XDT_m1220412-004	NA	04/12/22 17:01
CAL 1 - LOW CHECK	SKD0163-CAL2	XDT_m1220412-005	NA	04/12/22 17:06
CAL 2	SKD0163-CAL3	XDT_m1220412-006	NA	04/12/22 17:11
CAL 3	SKD0163-CAL4	XDT_m1220412-007	NA	04/12/22 17:17
CAL 4	SKD0163-CAL5	XDT_m1220412-008	NA	04/12/22 17:23
CAL 5	SKD0163-CAL6	XDT_m1220412-009	NA	04/12/22 17:30
RINSE	SKD0163-IBL1	XDT_m1220412-010	NA	04/12/22 17:38
Initial Cal Check	SKD0163-ICV1	XDT_m1220412-012	NA	04/12/22 17:49
Initial Cal Blank	SKD0163-ICB1	XDT_m1220412-013	NA	04/12/22 17:57
Calibration Check	SKD0163-CCV1	XDT_m1220412-015	NA	04/12/22 18:09
Calibration Blank	SKD0163-CCB1	XDT_m1220412-016	NA	04/12/22 18:17
Instrument RL Check	SKD0163-CRL1	XDT_m1220412-018	NA	04/12/22 18:29
Interference Check A	SKD0163-IFA1	XDT_m1220412-019	NA	04/12/22 18:34
Interference Check B	SKD0163-IFB1	XDT_m1220412-020	NA	04/12/22 18:40
LR300	SKD0163-HCV2	XDT_m1220412-022	NA	04/12/22 18:53
LR200	SKD0163-HCV1	XDT_m1220412-023	NA	04/12/22 19:01
Instrument Blank	SKD0163-IBL2	XDT_m1220412-024	NA	04/12/22 19:06
Instrument Blank	SKD0163-IBL3	XDT_m1220412-025	NA	04/12/22 19:13
Calibration Check	SKD0163-CCV2	XDT_m1220412-028	NA	04/12/22 19:39
Calibration Blank	SKD0163-CCB2	XDT_m1220412-029	NA	04/12/22 19:47
Instrument Blank	SKD0163-IBL4	XDT_m1220412-036	NA	04/12/22 20:29
Instrument Blank	SKD0163-IBL5	XDT_m1220412-039	NA	04/12/22 20:50
Calibration Check	SKD0163-CCV3	XDT_m1220412-040	NA	04/12/22 20:55
Calibration Blank	SKD0163-CCB3	XDT_m1220412-041	NA	04/12/22 21:03
Calibration Check	SKD0163-CCV4	XDT_m1220412-044	NA	04/12/22 21:24
Calibration Blank	SKD0163-CCB4	XDT_m1220412-045	NA	04/12/22 21:32
Instrument Blank	SKD0163-IBL6	XDT_m1220412-055	NA	04/12/22 22:34
Calibration Check	SKD0163-CCV5	XDT_m1220412-056	NA	04/12/22 22:39
Calibration Blank	SKD0163-CCB5	XDT_m1220412-057	NA	04/12/22 22:47

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Sequence: SKD0163
Instrument: ICPMS1
Calibration: FD00036

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
MW-CP5-032322	22C0456-06	XDT_m1220412-060	Water	04/12/22 23:09
Instrument Blank	SKD0163-IBL7	XDT_m1220412-067	NA	04/12/22 23:54
Calibration Check	SKD0163-CCV6	XDT_m1220412-068	NA	04/12/22 23:59
Calibration Blank	SKD0163-CCB6	XDT_m1220412-069	NA	04/13/22 00:07
Instrument Blank	SKD0163-IBL8	XDT_m1220412-076	NA	04/13/22 00:51
ZZZZZ	22C0395-06	XDT_m1220412-077	Water	04/13/22 00:56
ZZZZZ	22C0395-06	XDT_m1220412-077	Water	04/13/22 00:56
ZZZZZ	22C0395-06	XDT_m1220412-077	Water	04/13/22 00:56
ZZZZZ	22C0395-06	XDT_m1220412-077	Water	04/13/22 00:56
ZZZZZ	22C0395-08	XDT_m1220412-078	Water	04/13/22 01:03
ZZZZZ	22C0395-08	XDT_m1220412-078	Water	04/13/22 01:03
ZZZZZ	22C0395-08	XDT_m1220412-078	Water	04/13/22 01:03
ZZZZZ	22C0395-08	XDT_m1220412-078	Water	04/13/22 01:03
Instrument Blank	SKD0163-IBL9	XDT_m1220412-079	NA	04/13/22 01:12
Calibration Check	SKD0163-CCV7	XDT_m1220412-080	NA	04/13/22 01:17
Calibration Blank	SKD0163-CCB7	XDT_m1220412-081	NA	04/13/22 01:25
ZZZZZ	22C0395-10	XDT_m1220412-086	Water	04/13/22 01:57
ZZZZZ	22C0395-10	XDT_m1220412-086	Water	04/13/22 01:57
ZZZZZ	22C0395-10	XDT_m1220412-086	Water	04/13/22 01:57
ZZZZZ	22C0395-10	XDT_m1220412-086	Water	04/13/22 01:57
ZZZZZ	22C0395-04	XDT_m1220412-087	Water	04/13/22 02:02
ZZZZZ	22C0395-04	XDT_m1220412-087	Water	04/13/22 02:02
ZZZZZ	22C0395-04	XDT_m1220412-087	Water	04/13/22 02:02
ZZZZZ	22C0395-02	XDT_m1220412-088	Water	04/13/22 02:07
ZZZZZ	22C0395-02	XDT_m1220412-088	Water	04/13/22 02:07
ZZZZZ	22C0395-02	XDT_m1220412-088	Water	04/13/22 02:07
Instrument Blank	SKD0163-IBLA	XDT_m1220412-091	NA	04/13/22 02:28
Calibration Check	SKD0163-CCV8	XDT_m1220412-092	NA	04/13/22 02:34
Calibration Blank	SKD0163-CCB8	XDT_m1220412-093	NA	04/13/22 02:42

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6020B

Laboratory: Analytical Resources, LLC

SDG: 22C0456

Client: Floyd - Snider

Project: Lora Lake 2021-2023 sec II. 5.3.21

Sequence: SKD0163

Instrument: ICPMS1

Calibration: FD00036

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
Calibration Check	SKD0163-CCV9	XDT_m1220412-095	NA	04/13/22 02:52
Calibration Blank	SKD0163-CCB9	XDT_m1220412-096	NA	04/13/22 03:00
ZZZZZ	22C0403-02	XDT_m1220412-102	Water	04/13/22 03:32
Instrument Blank	SKD0163-IBLB	XDT_m1220412-106	NA	04/13/22 03:59
Calibration Check	SKD0163-CCVA	XDT_m1220412-107	NA	04/13/22 04:04
Calibration Blank	SKD0163-CCBA	XDT_m1220412-108	NA	04/13/22 04:12
Instrument Blank	SKD0163-IBLC	XDT_m1220412-118	NA	04/13/22 05:14
Calibration Check	SKD0163-CCVB	XDT_m1220412-119	NA	04/13/22 05:19
Calibration Blank	SKD0163-CCBB	XDT_m1220412-120	NA	04/13/22 05:27
Instrument Blank	SKD0163-IBLD	XDT_m1220412-130	NA	04/13/22 06:26
Calibration Check	SKD0163-CCVC	XDT_m1220412-131	NA	04/13/22 06:31
Calibration Blank	SKD0163-CCBC	XDT_m1220412-132	NA	04/13/22 06:39
Instrument Blank	SKD0163-IBLE	XDT_m1220412-142	NA	04/13/22 07:38
Calibration Check	SKD0163-CCVD	XDT_m1220412-143	NA	04/13/22 07:43
Calibration Blank	SKD0163-CCBD	XDT_m1220412-144	NA	04/13/22 07:51
Calibration Check	SKD0163-CCVE	XDT_m1220412-146	NA	04/13/22 08:02
Calibration Blank	SKD0163-CCBE	XDT_m1220412-147	NA	04/13/22 08:10
ZZZZZ	BKD0333-BLK1	XDT_m1220412-148	Water	04/13/22 08:15
ZZZZZ	BKD0333-BS1	XDT_m1220412-149	Water	04/13/22 08:20
ZZZZZ	22C0433-06	XDT_m1220412-152	Water	04/13/22 08:37
ZZZZZ	22C0433-06	XDT_m1220412-152	Water	04/13/22 08:37
ZZZZZ	22C0433-06	XDT_m1220412-152	Water	04/13/22 08:37
ZZZZZ	22C0433-06	XDT_m1220412-152	Water	04/13/22 08:37
ZZZZZ	22C0433-06	XDT_m1220412-152	Water	04/13/22 08:37
ZZZZZ	22C0433-06	XDT_m1220412-152	Water	04/13/22 08:37
ZZZZZ	22C0433-06	XDT_m1220412-152	Water	04/13/22 08:37
ZZZZZ	22C0433-06	XDT_m1220412-152	Water	04/13/22 08:37
ZZZZZ	22C0433-06	XDT_m1220412-152	Water	04/13/22 08:37
ZZZZZ	22C0433-06	XDT_m1220412-152	Water	04/13/22 08:37

Analytical Resources, LLC
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ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6020B

Laboratory: Analytical Resources, LLC | SDG: 22C0456
Client: Floyd - Snider | Project: Lora Lake 2021-2023 sec II. 5.3.21
Sequence: SKD0163 | Instrument: ICPMS1
Calibration: FD00036

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
ZZZZZ	22C0433-04	XDT_m1220412-153	Water	04/13/22 08:42
ZZZZZ	22C0433-04	XDT_m1220412-153	Water	04/13/22 08:42
ZZZZZ	22C0433-04	XDT_m1220412-153	Water	04/13/22 08:42
ZZZZZ	22C0433-04	XDT_m1220412-153	Water	04/13/22 08:42
ZZZZZ	22C0433-04	XDT_m1220412-153	Water	04/13/22 08:42
ZZZZZ	22C0433-04	XDT_m1220412-153	Water	04/13/22 08:42
ZZZZZ	22C0433-04	XDT_m1220412-153	Water	04/13/22 08:42
ZZZZZ	22C0433-04	XDT_m1220412-153	Water	04/13/22 08:42
ZZZZZ	22C0433-04	XDT_m1220412-153	Water	04/13/22 08:42
ZZZZZ	22C0433-04	XDT_m1220412-153	Water	04/13/22 08:42
Instrument Blank	SKD0163-IBLF	XDT_m1220412-157	NA	04/13/22 09:08
Calibration Check	SKD0163-CCVF	XDT_m1220412-158	NA	04/13/22 09:14
Calibration Blank	SKD0163-CCBF	XDT_m1220412-159	NA	04/13/22 09:22
ZZZZZ	22C0433-02	XDT_m1220412-165	Water	04/13/22 09:54
ZZZZZ	22C0433-02	XDT_m1220412-165	Water	04/13/22 09:54
ZZZZZ	22C0433-02	XDT_m1220412-165	Water	04/13/22 09:54
ZZZZZ	22C0433-02	XDT_m1220412-165	Water	04/13/22 09:54
ZZZZZ	22C0433-02	XDT_m1220412-165	Water	04/13/22 09:54
ZZZZZ	22C0433-02	XDT_m1220412-165	Water	04/13/22 09:54
ZZZZZ	22C0433-02	XDT_m1220412-165	Water	04/13/22 09:54
ZZZZZ	22C0433-02	XDT_m1220412-165	Water	04/13/22 09:54
ZZZZZ	22C0433-02	XDT_m1220412-165	Water	04/13/22 09:54
ZZZZZ	22C0433-02	XDT_m1220412-165	Water	04/13/22 09:54
Instrument Blank	SKD0163-IBLG	XDT_m1220412-169	NA	04/13/22 10:20
Calibration Check	SKD0163-CCVG	XDT_m1220412-170	NA	04/13/22 10:26
Calibration Blank	SKD0163-CCBG	XDT_m1220412-171	NA	04/13/22 10:34
ZZZZZ	22C0435-08	XDT_m1220412-176	Water	04/13/22 11:02
ZZZZZ	22C0435-08	XDT_m1220412-176	Water	04/13/22 11:02
ZZZZZ	22C0435-08	XDT_m1220412-176	Water	04/13/22 11:02

Analytical Resources, LLC
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Sequence: SKD0163
Instrument: ICPMS1
Calibration: FD00036

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
ZZZZZ	22C0435-08	XDT_m1220412-176	Water	04/13/22 11:02
ZZZZZ	22C0435-08	XDT_m1220412-176	Water	04/13/22 11:02
ZZZZZ	22C0435-08	XDT_m1220412-176	Water	04/13/22 11:02
ZZZZZ	22C0435-08	XDT_m1220412-176	Water	04/13/22 11:02
ZZZZZ	22C0435-08	XDT_m1220412-176	Water	04/13/22 11:02
ZZZZZ	22C0435-08	XDT_m1220412-176	Water	04/13/22 11:02
ZZZZZ	22C0435-08	XDT_m1220412-176	Water	04/13/22 11:02
Instrument Blank	SKD0163-IBLH	XDT_m1220412-180	NA	04/13/22 11:28
Calibration Check	SKD0163-CCVH	XDT_m1220412-181	NA	04/13/22 11:33
Calibration Blank	SKD0163-CCBH	XDT_m1220412-182	NA	04/13/22 11:41

Analytical Resources, LLC
Analytical Chemists and Consultants

ICP INTERFERENCE CHECK SAMPLE

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00028
Sequence: SKD0126
Standard ID: K003019

Lab Sample ID	Analyte	True	Found	%R	Units
SKD0126-IFA1	Arsenic-75a (dissolved)	0	0.0330		ug/L

* Indicates %R outside of QC limits

NOTE: True value and %R are populated only for analytes found in the interference check standards, and will be seen only if those analytes were requested.

Analytical Resources, LLC
Analytical Chemists and Consultants

ICP INTERFERENCE CHECK SAMPLE

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00028
Sequence: SKD0126
Standard ID: K003019

Lab Sample ID	Analyte	True	Found	%R	Units
SKD0126-IFB1	Arsenic-75a (dissolved)	20.000	19.274	96.4	ug/L

* Indicates %R outside of QC limits

NOTE: True value and %R are populated only for analytes found in the interference check standards, and will be seen only if those analytes were requested.

Analytical Resources, LLC
Analytical Chemists and Consultants

ICP INTERFERENCE CHECK SAMPLE

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00031
Sequence: SKD0140
Standard ID: K003019

Lab Sample ID	Analyte	True	Found	%R	Units
SKD0140-IFA1	Arsenic-75a (dissolved)	0	0.0200		ug/L

* Indicates %R outside of QC limits

NOTE: True value and %R are populated only for analytes found in the interference check standards, and will be seen only if those analytes were requested.

Analytical Resources, LLC
Analytical Chemists and Consultants

ICP INTERFERENCE CHECK SAMPLE

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00031
Sequence: SKD0140
Standard ID: K003019

Lab Sample ID	Analyte	True	Found	%R	Units
SKD0140-IFB1	Arsenic-75a (dissolved)	20.000	19.983	99.9	ug/L

* Indicates %R outside of QC limits

NOTE: True value and %R are populated only for analytes found in the interference check standards, and will be seen only if those analytes were requested.

Analytical Resources, LLC
Analytical Chemists and Consultants

ICP INTERFERENCE CHECK SAMPLE

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00036
Sequence: SKD0163
Standard ID: K003019

Lab Sample ID	Analyte	True	Found	%R	Units
SKD0163-IFA1	Arsenic-75a (dissolved)	0	0.0080		ug/L

* Indicates %R outside of QC limits

NOTE: True value and %R are populated only for analytes found in the interference check standards, and will be seen only if those analytes were requested.

Analytical Resources, LLC
Analytical Chemists and Consultants

ICP INTERFERENCE CHECK SAMPLE

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00036
Sequence: SKD0163
Standard ID: K003019

Lab Sample ID	Analyte	True	Found	%R	Units
SKD0163-IFB1	Arsenic-75a (dissolved)	20.000	17.329	86.6	ug/L

* Indicates %R outside of QC limits

NOTE: True value and %R are populated only for analytes found in the interference check standards, and will be seen only if those analytes were requested.

Analytical Resources, LLC
Analytical Chemists and Consultants

DETECTION LEVEL STANDARD
EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00028
Sequence: SKD0126
Lab Sample ID: SKD0126-CRL1

Analyte	True	Found	%R	Units	QC Limts
Arsenic-75a (dissolved)	0.20000	0.182	91.0	ug/L	50 - 150

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

DETECTION LEVEL STANDARD
EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00031
Sequence: SKD0140
Lab Sample ID: SKD0140-CRL1

Analyte	True	Found	%R	Units	QC Limts
Arsenic-75a (dissolved)	0.20000	0.238	119	ug/L	50 - 150

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

DETECTION LEVEL STANDARD
EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Instrument ID: ICPMS1
Calibration: FD00036
Sequence: SKD0163
Lab Sample ID: SKD0163-CRL1

Analyte	True	Found	%R	Units	QC Limts
Arsenic-75a (dissolved)	0.20000	0.189	94.5	ug/L	50 - 150

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

HIGH-CONCENTRATION CALIBRATION VERIFICATION

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Calibration: FD00028
Laboratory ID: SKD0126-HCV1
Sequence: SKD0126
Standard ID: K003127

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Arsenic-75a (dissolved)	200.00	202	0.8	10.00

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

HIGH-CONCENTRATION CALIBRATION VERIFICATION

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Calibration: FD00028
Laboratory ID: SKD0126-HCV2
Sequence: SKD0126
Standard ID: K002820

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Arsenic-75a (dissolved)	300.00	307	2.4	10.00

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

HIGH-CONCENTRATION CALIBRATION VERIFICATION

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Calibration: FD00031
Laboratory ID: SKD0140-HCV1
Sequence: SKD0140
Standard ID: K003127

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Arsenic-75a (dissolved)	200.00	204	1.8	10.00

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

HIGH-CONCENTRATION CALIBRATION VERIFICATION

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Calibration: FD00031
Laboratory ID: SKD0140-HCV2
Sequence: SKD0140
Standard ID: K002820

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Arsenic-75a (dissolved)	300.00	313	4.3	10.00

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

HIGH-CONCENTRATION CALIBRATION VERIFICATION

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Calibration: FD00036
Laboratory ID: SKD0163-HCV1
Sequence: SKD0163
Standard ID: K003127

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Arsenic-75a (dissolved)	200.00	192	-4.1	10.00

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

HIGH-CONCENTRATION CALIBRATION VERIFICATION

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Calibration: FD00036
Laboratory ID: SKD0163-HCV2
Sequence: SKD0163
Standard ID: K003531

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Arsenic-75a (dissolved)	300.00	299	-0.2	10.00

* Values outside of QC limits

Analytical Resources, LLC
Analytical Chemists and Consultants

HOLDING TIME SUMMARY

Analysis: EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21

Sample Name	Date Collected	Date Received	Date Prepared	Days to Prep	Max Days to Prep	Date Analyzed	Days to Analysis	Max Days to Analysis	Q
MW-CP1-032322 22C0456-01	03/23/22 14:26	03/24/22 13:35	04/07/22 12:08	14	180	04/11/22 22:43	19	180	
MW-CP1-032322-D 22C0456-02	03/23/22 14:36	03/24/22 13:35	04/07/22 12:08	14	180	04/11/22 22:25	19	180	
MW-CP2-032322 22C0456-03	03/23/22 13:26	03/24/22 13:35	04/07/22 12:08	14	180	04/11/22 22:28	19	180	
MW-CP3-032322 22C0456-04	03/23/22 13:25	03/24/22 13:35	04/07/22 12:08	14	180	04/11/22 22:36	19	180	
MW-CP4-032322 22C0456-05	03/23/22 12:06	03/24/22 13:35	04/07/22 12:08	15	180	04/11/22 22:39	19	180	
MW-CP5-032322 22C0456-06	03/23/22 12:25	03/24/22 13:35	04/07/22 12:08	14	180	04/12/22 23:09	20	180	
MW-CP6-032322 22C0456-07	03/23/22 11:15	03/24/22 13:35	04/07/22 12:08	15	180	04/11/22 23:12	19	180	
MW-CP7-032322 22C0456-08	03/23/22 11:06	03/24/22 13:35	04/07/22 12:08	15	180	04/11/22 23:16	20	180	
MW-VB3-032322 22C0456-09	03/23/22 09:36	03/24/22 13:35	04/07/22 12:08	15	180	04/11/22 23:19	20	180	
HCOO-B312-032322 22C0456-10	03/23/22 15:00	03/24/22 13:35	04/07/22 12:08	14	180	04/11/22 23:23	19	180	
MW-C1-VB1-032422 22C0456-11	03/24/22 12:33	03/24/22 13:35	04/07/22 12:08	13	180	04/11/22 23:27	18	180	
MW-C1-VB1-032422-D 22C0456-12	03/24/22 12:37	03/24/22 13:35	04/07/22 12:08	13	180	04/11/22 23:30	18	180	
MW-C2-032422 22C0456-13	03/24/22 11:36	03/24/22 13:35	04/07/22 12:08	14	180	04/11/22 23:34	18	180	
MW-C3-032422 22C0456-14	03/24/22 11:33	03/24/22 13:35	04/07/22 12:08	14	180	04/11/22 23:38	19	180	
MW-C1-VB2-032422 22C0456-15	03/24/22 10:30	03/24/22 13:35	04/07/22 12:08	14	180	04/11/22 23:57	19	180	
Duplicate BKD0201-DUP1	03/23/22 14:26	03/24/22 13:35	04/07/22 12:08	14	180	04/11/22 22:46	19	180	
Matrix Spike BKD0201-MS1	03/23/22 14:26	03/24/22 13:35	04/07/22 12:08	14	180	04/11/22 22:50	19	180	

* Indicates hold time exceedance.

Analytical Resources, LLC
Analytical Chemists and Consultants

METHOD DETECTION AND REPORTING LIMITS

EPA 6020B

Laboratory: Analytical Resources, LLC
SDG: 22C0456
Client: Floyd - Snider
Project: Lora Lake 2021-2023 sec II. 5.3.21
Matrix: Water
Instrument: ICPMS1

Analyte	MDL	RL	Units
Arsenic-75a (dissolved)	0.0373	0.200	ug/L

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

tel: 800.669.6799 · 540.585.3030
fax: 540.585.3012
info@inorganicventures.com

1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGAG10
Lot Number:	P2-AG688237
Matrix:	7% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Silver
Starting Material:	Ag Shot
Starting Material Lot#:	2217
Starting Material Purity:	99.9993%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10004 ± 30 µg/mL

Density: 1.054 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **9984 ± 32 µg/mL**
ICP Assay NIST SRM 3151 Lot Number: 160729

Assay Method #2 **10016 ± 26 µg/mL**
Volhard NIST SRM 999c Lot Number: 999c

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

s	Ag	<		M	Eu	<	0.000253	O	Na		0.005563	M	Se	<	0.018179	M	Zn		0.005800
O	Al		0.006296	O	Fe		0.002932	M	Nb	<	0.000253	M	Si		0.022487	M	Zr	<	0.005559
M	As	<	0.002403	M	Ga	<	0.000253	M	Nd	<	0.000253	M	Sm	<	0.000253				
M	Au		0.001635	M	Gd	<	0.000253	O	Ni	<	0.005472	M	Sn		0.001928				
O	B	<	0.009978	M	Ge	<	0.000754	M	Os	<	0.000254	O	Sr		0.000086				
M	Ba	<	0.000785	M	Hf	<	0.000253	M	P	<	0.053784	M	Ta	<	0.000253				
M	Be	<	0.002407	M	Hg	<	0.001332	M	Pb		0.003281	M	Tb	<	0.000253				
M	Bi		0.001671	M	Ho	<	0.000253	M	Pd	<	0.001382	M	Te	<	0.003715				
O	Ca		0.007116	M	In	<	0.003483	M	Pr	<	0.000253	M	Th	<	0.000253				
M	Cd	<	0.000253	M	Ir	<	0.000254	M	Pt	<	0.000253	M	Ti	<	0.002706				
M	Ce	<	0.000573	O	K		0.004010	M	Rb	<	0.000253	M	Tl	<	0.000253				
M	Co	<	0.000253	M	La	<	0.000253	M	Re	<	0.000253	M	Tm	<	0.000253				
O	Cr	<	0.005043	O	Li	<	0.000214	M	Rh	<	0.000253	M	U	<	0.000253				
M	Cs	<	0.002769	M	Lu	<	0.000253	M	Ru	<	0.000254	M	V	<	0.000822				
O	Cu		0.004614	O	Mg		0.001035	M	S	<	0.560935	M	W	<	0.002146				
M	Dy	<	0.000253	M	Mn	<	0.000253	M	Sb	<	0.006899	M	Y	<	0.000253				
M	Er	<	0.000253	M	Mo	<	0.000479	M	Sc	<	0.000733	M	Yb	<	0.000253				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 107.87 +1 6 $Ag(H_2O)_6^+$

Chemical Compatibility -Stable in HNO_3, and HF. Avoid basic media. Ag forms more insoluble salts than any other metal. It also is subject to photochemical reduction to the metal in HCl media although 10 µg/mL solutions in 10% HCl [$AgCl_{x1-x}$] are commonly used in the analytical laboratory. The most common solubility problems exist with arsenate, arsenite , bromide, chloride, iodide, carbonate , chromate, cyanide, iodate, oxalate, oxide, sulfate, sulfide, tartrate, and thiocyanate in aqueous media. The addition of nitric acid renders many of these salts soluble.

Stability - 2-100 ppb levels stable for 75+ days when mixed with equivalent levels of all other elements including the precious metals (where chloride is present) when in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.

Ag Containing Samples (Preparation and Solution) -Metal (Soluble in HNO_3); Oxides (Soluble in HNO_3); Ores (Digestion with conc. HNO_3).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 107 amu	1 ppt	N/A	91Zr16O
ICP-OES 243.779 nm	0.12/0.01 µg/mL	1	Mn, Th, Ni, Rh
ICP-OES 328.068 nm	0.007/0.0007 µg/mL	1	Ce, Rh, V
ICP-OES 338.289 nm	0.013/0.001 µg/mL	1	Ce, Cr, Th

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

January 29, 2020

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **January 29, 2024**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

tel: 800.669.6799 · 540.585.3030
fax: 540.585.3012
info@inorganicventures.com

1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGAL10
Lot Number:	S2-AL700843
Matrix:	7% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Aluminum
Starting Material:	Al(NO3)3 * 9H2O
Starting Material Lot#:	P2-2302
Starting Material Purity:	99.9913%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10011 ± 31 µg/mL

Density: 1.087 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10015 ± 44 µg/mL**
ICP Assay NIST SRM 3101a Lot Number: 140903

Assay Method #2 **10008 ± 25 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

Assay Method #3 **10014 ± 36 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.001500	M	Eu	<	0.000680	O	Na		0.510200	M	Se	<	0.014000	M	Zn	0.009183
s	Al	<		O	Fe		0.114284	M	Nb	<	0.000680	O	Si		0.053060	O	Zr	0.003673
M	As	<	0.006800	O	Ga		0.191835	M	Nd	<	0.000680	M	Sm	<	0.000680			
M	Au	<	0.000680	M	Gd	<	0.004100	O	Ni		0.001102	M	Sn	<	0.006800			
O	B	<	0.021000	M	Ge	<	0.001400	M	Os	<	0.008700	O	Sr		0.006530			
O	Ba		0.012652	M	Hf	<	0.002700	n	P	<		M	Ta	<	0.000680			
O	Be	<	0.001300	M	Hg	<	0.006100	M	Pb		0.006530	M	Tb	<	0.000680			
M	Bi	<	0.008100	M	Ho	<	0.000680	M	Pd	<	0.000680	M	Te	<	0.030000			
O	Ca		0.071428	M	In	<	0.000900	M	Pr	<	0.000680	M	Th	<	0.000680			
M	Cd	<	0.001400	M	Ir	<	0.000680	M	Pt	<	0.000680	O	Ti		0.001142			
M	Ce	<	0.002700	O	K		0.053060	M	Rb	<	0.014000	M	Tl	<	0.000680			
O	Co		0.001979	M	La	<	0.002900	M	Re	<	0.000680	M	Tm	<	0.000680			
O	Cr		0.014285	O	Li		0.000142	M	Rh	<	0.000680	M	U	<	0.001400			
M	Cs		0.005306	M	Lu	<	0.000680	M	Ru	<	0.000680	M	V	<	0.005400			
O	Cu		0.003469	O	Mg		0.069387	i	S	<		M	W	<	0.012000			
M	Dy	<	0.005400	O	Mn		0.001653	M	Sb	<	0.004200	M	Y	<	0.000680			
M	Er	<	0.000680	M	Mo	<	0.012000	M	Sc	<	0.002100	M	Yb	<	0.000680			

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 26.98 +3 6 Al(H2O)6+3
Chemical Compatibility -Soluble in HCl, HNO3, HF and H2SO4. Avoid neutral media. Soluble in strongly basic NaOH forming the Al(OH)4(H2O)21- species. Stable with most metals and inorganic anions. The phosphate is insoluble in water and only slightly soluble in acid.
Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 2-5% HNO3 / LDPE container.
Al Containing Samples (Preparation and Solution) -Metal (Best dissolved in HCl / HNO3); a- Al2O3 (Na2CO3 fusion in Pt0);
Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 27 amu	30 ppt	N/A	12C15N, 13C14N, 1H12C14N, 11B16O, 54Cr2+, 54Fe2+
ICP-OES 167.078 nm	0.1/0.009 µg/mL	1	Fe
ICP-OES 394.401 nm	0.05/0.006 µg/mL	1	U, Ce
ICP-OES 396.152 nm	0.03/0.006 µg/mL	1	Mo, Zr, Ce

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

January 27, 2021

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **January 27, 2025**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Director, Quality Control

Certifying Officer:

Paul Gaines
Chairman / Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

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fax: 540.585.3012
info@inorganicventures.com

1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGAS10
Lot Number:	R2-AS691113
Matrix:	2% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Arsenic
Starting Material:	As Pieces
Starting Material Lot#:	2208
Starting Material Purity:	99.9980%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 9981 ± 55 µg/mL

Density: 1.028 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **9981 ± 55 µg/mL**
ICP Assay NIST SRM 3103a Lot Number: 100818

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The follow ing equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2 (u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.001578	M	Eu	<	0.000526	O	Na		0.036136	M	Se	<	0.014204	O	Zn	<	0.003390
O	Al		0.006694	M	Fe		0.002633	O	Nb	<	0.011526	O	Si		0.139479	M	Zr	<	0.003156
s	As	<		M	Ga	<	0.000526	M	Nd	<	0.000526	M	Sm	<	0.000526				
M	Au	<	0.000526	M	Gd	<	0.000526	O	Ni	<	0.005537	M	Sn	<	0.001052				
M	B		0.017011	M	Ge	<	0.000526	M	Os	<	0.000526	M	Sr	<	0.000526				
M	Ba	<	0.000526	M	Hf	<	0.000526	O	P	<	0.056500	M	Ta	<	0.000526				
O	Be	<	0.001130	M	Hg	<	0.002104	M	Pb	<	0.000526	M	Tb	<	0.000526				
M	Bi	<	0.002104	M	Ho	<	0.000526	M	Pd	<	0.000526	M	Te	<	0.003682				
O	Ca		0.005657	M	In	<	0.000526	M	Pr	<	0.002630	M	Th	<	0.000526				
M	Cd	<	0.000526	M	Ir	<	0.000526	M	Pt	<	0.000526	O	Ti	<	0.001017				
M	Ce	<	0.000526	O	K		0.003865	M	Rb	<	0.002104	M	Tl	<	0.000526				
M	Co	<	0.003156	M	La	<	0.000526	M	Re	<	0.000526	M	Tm	<	0.000526				
M	Cr		0.000877	M	Li	<	0.000526	M	Rh	<	0.000526	M	U	<	0.000526				
M	Cs	<	0.002104	M	Lu	<	0.000526	M	Ru	<	0.000526	M	V	<	0.001578				
M	Cu	<	0.003156	O	Mg		0.000235	O	S	<	0.056500	M	W	<	0.000526				
M	Dy	<	0.000526	M	Mn	<	0.001052	M	Sb	<	0.000526	M	Y	<	0.000526				
M	Er	<	0.000526	M	Mo	<	0.000526	M	Sc	<	0.002104	M	Yb	<	0.000526				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 74.92 ; mix of +3 and +5 ; 6 ; H_3AsO_4 and $HAsO_2$

Chemical Compatibility - Arsenic has no cationic chemistry. It is soluble in HCl, HNO_3,H_3PO_4, H_2SO_4 and HF aqueous matrices water and NH_4OH . It is stable with most inorganic anions (forms arsenate when boiled with chromate) but many cationic metals form the insoluble arsenates under pH neutral conditions. When fluorinated and / or under acidic conditions arsenate formation is typically not a problem at moderate to low concentrations.

Stability - 2-100 ppb levels stable for months alone or mixed with other elements at equivalent levels in 1% HNO_3 / LDPE container.

As Containing Samples (Preparation and Solution) - Metal (soluble in 1:1 H_2O / HNO_3); Oxides (the oxide exists in crystalline and amorphous forms where the amorphic form is more water soluble. The oxides typically dissolve in dilute acidic solutions when boiled); Minerals (one gram of powered sample is fused in a Ni crucible with 10 grams of a 1:1 mix of K_2CO_3 and KNO_3 and the melt extracted with hot water); Organic Matrices (0.2 to 0.5 grams of sample are fused with 15 grams of a 1:1 Na_2CO_3 / Na_2O_2 mix in a Ni crucible. The fuseate is extracted with water and acidified with HNO_3).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 75 amu	20 ppt	N/A	40Ar35Cl, 59Co16O, 36Ar38Ar1H,8Ar37Cl,Ar39K, 150Nd2+,150Sm2+
ICP-OES 189.042 nm	0.05/0.005 µg/mL	1	Cr
ICP-OES 193.696 nm	0.1/0.01 µg/mL	1	V, Ge
ICP-OES 228.812 nm	0.1/0.01 µg/mL	1	Cd, Pt, Ir, Co

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

March 25, 2020

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **March 25, 2024**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

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CERTIFICATE OF ANALYSIS

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1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGBA10
Lot Number:	P2-BA682107
Matrix:	2% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Barium
Starting Material:	Ba(NO3)2
Starting Material Lot#:	Mixed Lots
Starting Material Purity:	99.9995%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10072 ± 32 µg/mL

Density: 1.024 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10054 ± 80 µg/mL**
ICP Assay NIST SRM 3104a Lot Number: 140909

Assay Method #2 **10075 ± 30 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.001538	O	Eu	<	0.028728	O	Na		0.006767	M	Se	<	0.007964	O	Zn		0.004335
M	Al		0.005194	M	Fe		0.016554	M	Nb	<	0.000200	O	Si	<	0.020780	M	Zr	<	0.000271
M	As	<	0.000519	M	Ga	<	0.000200	M	Nd	<	0.000200	M	Sm	<	0.082480				
M	Au	<	0.003452	M	Gd	<	0.000200	M	Ni	<	0.001290	M	Sn	<	0.000200				
M	B	<	0.002519	M	Ge	<	0.000430	M	Os	<	0.000752	O	Sr		0.027070				
s	Ba	<		M	Hf	<	0.002746	O	P	<	0.044677	M	Ta	<	0.001008				
M	Be	<	0.000430	M	Hg	<	0.001063	M	Pb	<	0.002257	M	Tb	<	0.000200				
M	Bi	<	0.002971	M	Ho	<	0.000200	M	Pd	<	0.000286	M	Te	<	0.001470				
O	Ca		0.026224	M	In	<	0.000200	M	Pr	<	0.000200	M	Th	<	0.000200				
M	Cd	<	0.000200	M	Ir	<	0.000446	M	Pt	<	0.000200	M	Ti	<	0.000324				
M	Ce	<	0.004362	O	K		0.011526	M	Rb		0.001487	M	Tl	<	0.000200				
M	Co	<	0.000200	O	La	<	0.091587	M	Re	<	0.000200	M	Tm	<	0.000954				
M	Cr	<	0.002191	O	Li	<	0.002181	M	Rh	<	0.000200	M	U	<	0.000200				
M	Cs	<	0.001640	M	Lu	<	0.002934	M	Ru	<	0.000200	M	V	<	0.000229				
M	Cu	<	0.003646	O	Mg		0.002379	O	S	<	0.073041	M	W	<	0.001627				
M	Dy	<	0.000200	M	Mn	<	0.000902	M	Sb	<	0.000514	O	Y	<	0.019637				
M	Er	<	0.000556	M	Mo	<	0.000455	M	Sc	<	0.000478	M	Yb	<	0.001991				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 137.33 +2 6 $Ba(H_2O)_6^{+2}$

Chemical Compatibility - Soluble in HCl, and HNO_3. Avoid H_2SO_4, HF and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, sulfate, oxalate, chromate, arsenate, iodate, molybdate, sulfite and tungstate in neutral aqueous media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1 -10,000 ppm solutions chemically stable for years in 1-3.5% HNO_3 / LDPE container.

Ba Containing Samples (Preparation and Solution) -Metal(is best dissolved in diluted HNO_3); Ores(Carbonate fusion in Pt0 followed by HCl dissolution. If sulfate is present dissolve the fuseate using HCl / tartaric acid to prevent $BaSO_4$ precipitate); Organic Matrices (dry ash and dissolve in dilute HCl.)

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 138 amu	1 ppt	N/A	122Sn16O, 122Te16O
ICP-OES 230.424 nm	0.004/0.0005 µg/mL	1	Mo, Ir, Co
ICP-OES 233.527 nm	0.004/0.0003 µg/mL	1	
ICP-OES 455.403 nm	0.002/0.0001 µg/mL	1	Zr, U

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

Inorganic Ventures, 300 Technology Drive, Christiansburg, Va. 24073, USA; Telephone: 800.669.6799; 540.585.3030, Fax: 540.585.3012; inorganicventures.com; info@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

September 13, 2019

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **September 13, 2023**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

tel: 800.669.6799 · 540.585.3030
fax: 540.585.3012
info@inorganicventures.com

1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGBE10
Lot Number:	P2-BE678865
Matrix:	6% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Beryllium
Starting Material:	Beryllium diacetate
Starting Material Lot#:	2221
Starting Material Purity:	99.9998%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10036 ± 35 µg/mL

Density: 1.140 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10051 ± 42 µg/mL**
ICP Assay NIST SRM 3105a Lot Number: 090514

Assay Method #2 **10008 ± 59 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag		0.045414	M	Eu	<	0.000254	O	Na		0.015009	M	Se	<	0.015257	O	Zn		0.004059
O	Al		0.008058	O	Fe		0.011749	M	Nb	<	0.000254	O	Si		0.063793	O	Zr	<	0.007064
M	As	<	0.006473	M	Ga	<	0.000254	M	Nd	<	0.000254	M	Sm	<	0.000254				
M	Au	<	0.000248	M	Gd	<	0.000254	M	Ni	<	0.002034	M	Sn	<	0.002542				
O	B	<	0.021661	M	Ge	<	0.000508	M	Os	<	0.000248	M	Sr	<	0.000254				
M	Ba		0.001760	M	Hf	<	0.000254	O	P	<	0.666500	M	Ta	<	0.000254				
s	Be	<		M	Hg	<	0.001244	M	Pb	<	0.001271	M	Tb	<	0.000254				
M	Bi	<	0.000254	M	Ho	<	0.000254	M	Pd	<	0.000254	M	Te	<	0.001780				
O	Ca		0.015256	M	In	<	0.000254	M	Pr	<	0.000254	M	Th	<	0.000254				
M	Cd	<	0.000254	M	Ir	<	0.000248	M	Pt	<	0.000254	O	Ti	<	0.002266				
M	Ce	<	0.000254	O	K		0.031127	M	Rb	<	0.000508	M	Tl	<	0.000254				
M	Co	<	0.004068	M	La	<	0.000254	M	Re	<	0.000254	M	Tm	<	0.000254				
M	Cr	<	0.001525	O	Li	<	0.000666	M	Rh	<	0.000254	M	U	<	0.000254				
M	Cs		0.001642	M	Lu	<	0.000254	M	Ru	<	0.000248	M	V	<	0.000508				
M	Cu	<	0.005085	O	Mg		0.001907	i	S	<		M	W	<	0.004068				
M	Dy	<	0.000254	O	Mn	<	0.001333	M	Sb	<	0.000254	M	Y	<	0.000254				
M	Er	<	0.000254	M	Mo	<	0.000762	O	Sc	<	0.001333	M	Yb	<	0.000254				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 9.01 +2 4 $Be(H_2O)_4^{+2}$

Chemical Compatibility -Soluble in HCl, HNO_3, H_2SO_4 and HF aqueous matrices. Stable with all metals and inorganic anions.

Stability - 2-100 ppb levels stable for months in 1 % HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 5-10 % HNO_3 / LDPE container.

Be Containing Samples (Preparation and Solution) - Meta l(is best dissolved in diluted H_2SO_4); BeO (boiling nitric, hydrochloric, or sulfuric acids or KHSO4 fusion); Ores (H_2SO_4/HF digestion or carbonate fusion in Pt0); Organic Matrices (sulfuric/peroxide digestion or nitric/sulfuric/perchloric acid decomposition, or dry ash and dissolution according to the BeO procedure above).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 9 amu	4 ppt	N/A	
ICP-OES 234.861 nm	0.0003/0.00016 µg/mL	1	Fe, Ta, Mo
ICP-OES 313.042 nm	0.0003/0.00009 µg/mL	1	V, Ce, U
ICP-OES 313.107 nm	0.0007/0.0005 µg/mL	1	Ce, Th, Tm

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

Inorganic Ventures, 300 Technology Drive, Christiansburg, Va. 24073, USA; Telephone: 800.669.6799; 540.585.3030, Fax: 540.585.3012; inorganicventures.com; info@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION, PERIOD OF VALIDITY AND REVISION HISTORY

11.1 Certification Issue Date

April 22, 2019

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **April 22, 2023**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

11.4 Revision Status

- Revision 1 - Revised on Thursday, Jan 14, 2021 by utruong. Revision was made for the following reason: Modified Section 7 Chemical Form in Solution.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Director, Quality Control

Certifying Officer:

Paul Gaines
Chairman / Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

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1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGCA10
Lot Number:	R2-CA697921
Matrix:	2% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Calcium
Starting Material:	Calcium Oxide
Starting Material Lot#:	P2-CA677788
Starting Material Purity:	99.9995%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 9985 ± 30 µg/mL

Density: 1.039 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **9976 ± 43 µg/mL**
ICP Assay NIST SRM 3109a Lot Number: 130213

Assay Method #2 **9965 ± 25 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

Assay Method #3 **10008 ± 26 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.002500	M	Eu	<	0.001300	M	Na		0.008214	O	Se	<	0.022000	O	Zn		0.001158
O	Al	<	0.030000	O	Fe		0.002316	M	Nb	<	0.001300	O	Si	<	0.022000	M	Zr	<	0.006200
O	As	<	0.025000	M	Ga	<	0.002500	M	Nd	<	0.001300	M	Sm	<	0.001300				
M	Au	<	0.013000	M	Gd	<	0.001300	O	Ni	<	0.005300	O	Sn	<	0.013000				
O	B	<	0.006900	O	Ge	<	0.018000	M	Os	<	0.002500	M	Sr		0.115847				
M	Ba		0.000905	M	Hf	<	0.002500	O	P	<	0.027000	M	Ta	<	0.008600				
O	Be	<	0.000270	M	Hg	<	0.001300	M	Pb		0.001685	M	Tb	<	0.001300				
M	Bi	<	0.002500	M	Ho	<	0.001300	M	Pd	<	0.006200	O	Te	<	0.045000				
s	Ca	<		M	In	<	0.001300	M	Pr	<	0.001300	M	Th	<	0.001300				
O	Cd	<	0.000540	M	Ir	<	0.001300	M	Pt	<	0.001300	O	Ti	<	0.004200				
M	Ce	<	0.001300	O	K		0.015797	M	Rb	<	0.014000	M	Tl	<	0.001300				
O	Co		0.000558	M	La	<	0.001300	M	Re	<	0.001300	M	Tm	<	0.001300				
O	Cr	<	0.006000	O	Li	<	0.006900	M	Rh	<	0.002500	M	U	<	0.001300				
M	Cs	<	0.001300	M	Lu	<	0.001300	M	Ru	<	0.003800	O	V	<	0.002200				
M	Cu	<	0.002500	O	Mg		0.002843	n	S	<		M	W	<	0.012000				
M	Dy	<	0.001300	O	Mn		0.000115	M	Sb	<	0.007400	M	Y	<	0.001300				
M	Er	<	0.001300	M	Mo		0.002527	O	Sc	<	0.006100	M	Yb	<	0.001300				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 40.08 +2 6 $Ca(H_2O)_6^{+2}$

Chemical Compatibility - Soluble in HCl and HNO_3. Avoid H_2SO_4, HF, H_3PO_4 and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicate, carbonate, hydroxide, oxide, fluoride, sulfate, oxalate, chromate, arsenate, and tungstate in neutral aqueous media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-10% HNO_3 / LDPE container.

Ca Containing Samples (Preparation and Solution) -Metal (best dissolved in diluted HNO_3); Ores (Carbonate fusion in Pt0 followed by HCl dissolution); Organic Matrices (dry ash and dissolution in dilute HCl. Do not heat when dissolving to avoid precipitation of SiO_2). The oxide, hydroxide, carbonate, phosphate, and fluoride of calcium are soluble in % levels of HCl or HNO_3. The sulfates (gypsum, anhydrite, etc.), certain silicates, and complex compounds require fusion with Na_2CO_3 followed by HCl / water dissolution. Note that contamination is a very real problem when analyzing for trace levels.

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 44 amu	1200 ppt	n/a	16O212C, 28Si16O, 88Sr
ICP-OES 393.366 nm	0.0002 / 0.00004 µg/mL	1	U, Ce
ICP-OES 396.847 nm	0.0005 / 0.00006 µg/mL	1	Th
ICP-OES 422.673 nm	0.01 / 0.001 µg/mL	1	Ge

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

November 09, 2020

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **November 09, 2024**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Director, Quality Control

Certifying Officer:

Paul Gaines
Chairman / Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

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1.0 ACCREDITATION / REGISTRATION

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ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGCD10
Lot Number:	P2-CD685077
Matrix:	3% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Cadmium
Starting Material:	Cd Shot
Starting Material Lot#:	1954
Starting Material Purity:	99.9996%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 9954 ± 30 µg/mL

Density: 1.029 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **9956 ± 54 µg/mL**
ICP Assay NIST SRM 3108 Lot Number: 130116

Assay Method #2 **9953 ± 32 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Ag	<	0.006348	M	Eu	<	0.010622	O	Na		0.004020	M	Se	<	0.008116	O	Zn	<	0.002152
O	Al		0.011566	M	Fe		0.003011	M	Nb	<	0.000405	O	Si		0.005480	M	Zr	<	0.000405
M	As	<	0.001623	M	Ga	<	0.000405	M	Nd	<	0.000405	M	Sm	<	0.000405				
M	Au	<	0.000405	M	Gd	<	0.000405	M	Ni	<	0.002840	M	Sn	<	0.001217				
M	B	<	0.004463	M	Ge	<	0.000405	M	Os	<	0.000405	M	Sr	<	0.000405				
O	Ba	<	0.000968	M	Hf	<	0.000405	O	P	<	0.045730	M	Ta	<	0.000405				
M	Be	<	0.000405	O	Hg	<	0.002152	M	Pb	<	0.002434	M	Tb	<	0.000405				
M	Bi	<	0.000405	M	Ho	<	0.000405	M	Pd	<	0.000405	M	Te	<	0.016636				
O	Ca		0.002946	O	In	<	0.021520	M	Pr	<	0.000405	M	Th	<	0.000405				
s	Cd	<		M	Ir	<	0.000405	M	Pt	<	0.000405	M	Ti	<	0.001217				
M	Ce	<	0.000405	O	K		0.008179	M	Rb	<	0.000405	M	Tl	<	0.004495				
M	Co	<	0.000405	M	La	<	0.000405	M	Re	<	0.000405	M	Tm	<	0.000405				
M	Cr		0.002907	M	Li	<	0.000405	M	Rh	<	0.000405	M	U	<	0.000405				
M	Cs	<	0.002374	M	Lu	<	0.000405	M	Ru	<	0.000405	M	V	<	0.003179				
M	Cu	<	0.002434	O	Mg		0.000137	O	S	<	0.037660	M	W	<	0.000405				
M	Dy	<	0.000405	M	Mn	<	0.001623	M	Sb	<	0.004057	M	Y	<	0.000405				
M	Er	<	0.000405	M	Mo	<	0.000811	M	Sc	<	0.001623	M	Yb	<	0.000811				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 112.41 +2 4 Cd2(OH) (aq)3+ and Cd(OH)(aq)

Chemical Compatibility -Stable in HCl, HNO3, H2SO4 , and HF. Avoid basic media forming insoluble carbonate and hydroxide.

Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5 % HNO3 / LDPE container.

Cd Containing Samples (Preparation and Solution) -Metal (soluble in HNO3); Oxides (soluble in HCl or HNO3); Ores (dissolve in HCl /HNO3 then take to fumes with H2SO4. The silica and lead sulfate are filtered off after the addition of water); Organic based (dry ash at 450°C and dissolve ash in HCl), (sulfuric / peroxide acid digestion).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 111 amu	11 ppt	n/a	95Mo16O
ICP-OES 214.438 nm	0.003 / 0.0003 µg/mL	1	Pt, Ir
ICP-OES 226.502 nm	0.003 / 0.0003 µg/mL	1	Ir
ICP-OES 228.802 nm	0.003 / 0.0003 µg/mL	1	Co, Ir, As, Pt

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

Inorganic Ventures, 300 Technology Drive, Christiansburg, Va. 24073, USA; Telephone: 800.669.6799; 540.585.3030, Fax: 540.585.3012; inorganicventures.com; info@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

November 08, 2019

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **November 08, 2023**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

tel: 800.669.6799 · 540.585.3030
fax: 540.585.3012
info@inorganicventures.com

1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGCO10
Lot Number:	N2-CO671028
Matrix:	3% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Cobalt
Starting Material:	COBALT
Starting Material Lot#:	1749
Starting Material Purity:	99.9978%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 9988 ± 34 µg/mL

Density: 1.057 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **9973 ± 32 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

Assay Method #2 **10024 ± 50 µg/mL**
ICP Assay NIST SRM traceable to 3113 Lot Number: M2-CO661665

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Ag		0.022956	M	Eu	<	0.000422	O	Na		0.008125	M	Se	<	0.009290	M	Zn		0.007197
O	Al		0.013621	O	Fe		0.048700	M	Nb	<	0.000422	O	Si		0.017539	M	Zr	<	0.014357
i	As	<		M	Ga	<	0.000844	M	Nd	<	0.017735	M	Sm	<	0.001689				
M	Au	<	0.000583	M	Gd		0.003247	O	Ni	<	0.043642	M	Sn	<	0.005067				
M	B	<	0.013512	M	Ge	<	0.004645	M	Os	<	0.000583	O	Sr		0.000841				
O	Ba		0.071210	M	Hf	<	0.000422	n	P	<		M	Ta	<	0.000422				
O	Be	<	0.001771	M	Hg	<	0.002334	M	Pb		0.010094	M	Tb	<	0.001689				
M	Bi		0.000614	M	Ho	<	0.000422	M	Pd	<	0.000422	M	Te	<	0.008445				
O	Ca		0.025034	M	In	<	0.003378	M	Pr	<	0.006756	M	Th	<	0.000422				
M	Cd	<	0.000844	M	Ir	<	0.000583	M	Pt	<	0.000422	M	Ti	<	0.002533				
M	Ce		0.002721	O	K		0.005785	M	Rb	<	0.001689	M	Tl	<	0.000422				
s	Co	<		M	La		0.000877	M	Re		0.016853	M	Tm	<	0.000422				
M	Cr	<	0.020269	O	Li		0.000262	M	Rh	<	0.000422	M	U	<	0.000422				
M	Cs		0.000877	M	Lu	<	0.000422	M	Ru	<	0.000583	M	V	<	0.001689				
M	Cu		0.007197	O	Mg		0.003444	n	S	<		M	W	<	0.000844				
M	Dy	<	0.000422	O	Mn	<	0.006072	M	Sb	<	0.005911	M	Y		0.001228				
M	Er	<	0.000422	M	Mo	<	0.005911	M	Sc	<	0.001689	M	Yb	<	0.003378				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 58.93 +2 6 $Co(H_2O)_6^{2+}$
Chemical Compatibility -Stable in HCl, HNO_3, H_2SO_4 ,HF, H_3PO_4. Avoid basic media. Stable with most metals and inorganic anions in acidic media.
Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.
Co Containing Samples (Preparation and Solution) - Metal (soluble in HNO_3); Oxides (Soluble in HCl); Ores (dissolve in HCl / HNO_3).
Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 59 amu	2 ppt	n/a	42Ca16O1H , 40Ar18O1H , 36Ar23Na, 43Ca16O, 24Mg35Cl
ICP-OES 228.616 nm	0.01/0.001 µg/mL	1	
ICP-OES 237.862 nm	0.01/0.002 µg/mL	1	W, Re, Al, Ta
ICP-OES 238.892 nm	0.01/0.002 µg/mL	1	Fe, W, Ta

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

Inorganic Ventures, 300 Technology Drive, Christiansburg, Va. 24073, USA; Telephone: 800.669.6799; 540.585.3030, Fax: 540.585.3012; inorganicventures.com; info@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

January 15, 2019

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **January 15, 2023**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Supervisor, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

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1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGCR(3)10
Lot Number:	R2-CR691013
Matrix:	10% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Chromium
Starting Material:	Cr METAL
Starting Material Lot#:	2077
Starting Material Purity:	99.9942%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10044 ± 40 µg/mL

Density: 1.082 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10057 ± 58 µg/mL**
ICP Assay NIST SRM 3112a Lot Number: 170630

Assay Method #2 **10035 ± 50 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The follow ing equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.000540	M	Eu	<	0.003200	O	Na		0.130091	M	Se	<	0.012000	O	Zn	<	0.002700
O	Al		0.016634	O	Fe		0.202602	M	Nb	<	0.022000	n	Si	<		M	Zr	<	0.020000
M	As		0.003838	O	Ga	<	0.031000	M	Nd	<	0.000540	M	Sm	<	0.035000				
M	Au	<	0.000540	M	Gd	<	0.000540	O	Ni		0.009170	M	Sn		0.004051				
M	B	<	0.049000	M	Ge	<	0.005400	M	Os	<	0.088000	O	Sr	<	0.000250				
O	Ba	<	0.002000	M	Hf	<	0.000540	i	P	<		M	Ta	<	0.000540				
O	Be	<	0.000250	M	Hg	<	0.001600	M	Pb		0.002559	M	Tb	<	0.000540				
M	Bi		0.008956	M	Ho	<	0.000540	M	Pd	<	0.001100	M	Te	<	0.004800				
O	Ca		0.074642	M	In	<	0.001100	M	Pr	<	0.000540	M	Th	<	0.000540				
M	Cd	<	0.000540	M	Ir	<	0.000540	M	Pt	<	0.000540	O	Ti		0.013435				
M	Ce	<	0.000540	O	K		0.034122	i	Rb	<		M	Tl	<	0.001100				
O	Co	<	0.002900	M	La	<	0.001100	M	Re	<	0.002700	O	Tm	<	0.001800				
s	Cr	<		O	Li	<	0.000130	M	Rh	<	0.032000	M	U	<	0.001100				
M	Cs	<	0.019000	M	Lu	<	0.000540	M	Ru	<	0.094000	O	V		0.159949				
O	Cu		0.010023	O	Mg		0.001450	i	S	<		M	W	<	0.028000				
M	Dy	<	0.000540	O	Mn	<	0.014000	M	Sb	<	0.008600	M	Y	<	0.001100				
M	Er	<	0.016000	O	Mo	<	0.013000	O	Sc	<	0.001400	M	Yb	<	0.000540				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 52.00 +3 6 $Cr(H_2O)_6^{3+}$

Chemical Compatibility -Stable in HCl, HNO_3, H_2SO_4, HF, H_3PO_4. Avoid basic media. Stable with most metals and inorganic anions in acidic media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.

Cr3 Containing Samples (Preparation and Solution) -Metal (soluble in HCl); Oxides/Ores (Chrome ore/oxides are very difficult to dissolve. The following procedures [A-D] are commonly used: A. Fusion with $KHSO_4$ and extraction with hot KCl. The residue fused with Na_2CO_3 and $KClO_3$, 3:1. B. Fusion with $NaKSO_4$ and NaF 2:1, C. Fusion with magnesia or lime and sodium or potassium carbonates, 4:1. D. Fusion with Na_2O_2 or NaOH and KNO_3 or NaOH and Na_2O_2. Nickel, iron, copper, or silver crucibles should be used for D. Platinum may be used for A, B, C); Organic Matrices (ash at 4500C followed by one of the fusion methods above or sulfuric/hydrogen peroxide acid digestions may be applicable to non oxide containing samples).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 52 amu	40 ppt	N/A	36S16O, 36Ar16O - The 50Cr, 53Cr, 54Cr lines suffer from many more potential interferences from sulfur, chlorine and argon compounds of oxygen, nitrogen and carbon.
ICP-OES 205.552 nm	0.006/0.0008 µg/mL	1	Os
ICP-OES 276.654 nm	0.01/0.001 µg/mL	1	Cu, Ta, V
ICP-OES 284.325 nm	0.008/0.0007 µg/mL	1	

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

Inorganic Ventures, 300 Technology Drive, Christiansburg, Va. 24073, USA; Telephone: 800.669.6799; 540.585.3030, Fax: 540.585.3012; inorganicventures.com; info@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

March 25, 2020

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **March 25, 2024**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

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1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGCU10
Lot Number:	R2-CU693370
Matrix:	3% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Copper
Starting Material:	Cu Metal
Starting Material Lot#:	2095
Starting Material Purity:	99.9996%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10016 ± 30 µg/mL

Density: 1.033 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10010 ± 55 µg/mL**
ICP Assay NIST SRM 3114 Lot Number: 121207

Assay Method #2 **10017 ± 26 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

Assay Method #3 **10015 ± 25 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.007542	M	Eu	<	0.000942	O	Na		0.001434	M	Se	<	0.016971	M	Zn	<	0.005657
O	Al	<	0.000609	O	Fe		0.008698	M	Nb	<	0.000942	O	Si		0.003052	M	Zr	<	0.000942
M	As	<	0.010371	M	Ga	<	0.000942	M	Nd	<	0.000942	M	Sm	<	0.000942				
M	Au	<	0.001885	M	Gd	<	0.000942	M	Ni		0.003780	M	Sn	<	0.005657				
O	B		0.003662	M	Ge	<	0.005657	M	Os	<	0.000942	M	Sr	<	0.000942				
M	Ba		0.004252	M	Hf	<	0.000942	O	P	<	0.031668	M	Ta	<	0.000942				
M	Be	<	0.000942	O	Hg	<	0.007064	M	Pb		0.005788	M	Tb	<	0.000942				
M	Bi	<	0.000942	M	Ho	<	0.000942	M	Pd	<	0.000942	M	Te	<	0.004714				
O	Ca		0.002304	M	In	<	0.000942	M	Pr	<	0.000942	M	Th	<	0.000942				
M	Cd	<	0.000942	M	Ir	<	0.000942	M	Pt	<	0.000942	O	Ti	<	0.002801				
M	Ce	<	0.000942	O	K		0.000762	M	Rb	<	0.000942	M	Tl	<	0.000942				
M	Co		0.001890	M	La	<	0.000942	M	Re	<	0.000942	M	Tm	<	0.000942				
M	Cr	<	0.005657	O	Li	<	0.000243	i	Rh	<		M	U	<	0.000942				
M	Cs	<	0.000942	M	Lu	<	0.000942	M	Ru	<	0.039588	M	V	<	0.003771				
s	Cu	<		O	Mg		0.000320	O	S		0.007172	M	W	<	0.005657				
M	Dy	<	0.000942	O	Mn		0.000793	M	Sb	<	0.001885	M	Y	<	0.000942				
M	Er	<	0.000942	M	Mo	<	0.005657	M	Sc	<	0.000942	M	Yb	<	0.000942				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 63.55 +2 6 $Cu(H_2O)_6^{2+}$

Chemical Compatibility -Stable in HCl, HNO_3, H_2SO_4, HF, H_3PO_4. Avoid basic media. Stable with most metals and inorganic anions in acidic media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.

Cu Containing Samples (Preparation and Solution) -Metal (soluble in HNO_3); Oxides (Soluble in HCl); Ores (Dissolve in HCl / HNO_3).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 63 amu	10 ppt	n/a	40Ar23Na 47Ti16O, 14N12C37Cl, 16O12C35Cl, 23Na40Ca
ICP-OES 219.958 nm	0.01/.002 µg/mL	1	Th, Ta, Nb, U, Hf
ICP-OES 224.700 nm	0.01/.001 µg/mL	1	Pb, Ir, Ni, W
ICP-OES 324.754 nm	0.06/.001 µg/mL		Nb, U, Th, Mo, Hf

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

June 05, 2020

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **June 05, 2024**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

Certificate of Analysis

300 Technology Drive
Christiansburg, VA 24073 USA
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F: 540-585-3012
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1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Multi Analyte Custom Grade Solution
Catalog Number:	ARI-1
Lot Number:	S2-MEB704284
Matrix:	5% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Iron

3.0 CERTIFIED VALUES AND UNCERTAINTIES

ANALYTE	CERTIFIED VALUE	ANALYTE	CERTIFIED VALUE
Iron, Fe	**10 000.0 ± 40.0 µg/mL**		

Density: 1.033 g/mL (measured at 20 ± 4 ºC)

Assay Information:

ANALYTE	METHOD	NIST SRM#	SRM LOT#
Fe	ICP Assay	3126a	140812
Fe	EDTA	928	928

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

N/A

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

April 20, 2021

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **April 20, 2025**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Director, Quality Control

Certifying Officer:

Paul Gaines
Chairman / Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
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inorganicventures.com

CERTIFICATE OF ANALYSIS

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1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGK10
Lot Number:	S2-K700978
Matrix:	2% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Potassium
Starting Material:	KNO3
Starting Material Lot#:	2313
Starting Material Purity:	99.9971%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10016 ± 30 µg/mL

Density: 1.025 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10018 ± 54 µg/mL**
ICP Assay NIST SRM 3141a Lot Number: 140813

Assay Method #2 **10016 ± 24 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

Assay Method #3 **10014 ± 45 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\ (u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\ (u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.001400	M	Eu	<	0.000660	O	Na		0.240000	M	Se	<	0.007900	O	Zn	0.017000
O	Al		0.001600	O	Fe		0.005800	M	Nb	<	0.000660	O	Si		0.012000	O	Zr	< 0.001600
M	As	<	0.005300	M	Ga	<	0.000660	M	Nd	<	0.000660	M	Sm	<	0.000660			
M	Au	<	0.002000	M	Gd	<	0.000660	O	Ni	<	0.004900	M	Sn	<	0.000660			
O	B	<	0.005600	M	Ge	<	0.002000	M	Os	<	0.003300	O	Sr		0.000055			
O	Ba	<	0.000860	M	Hf	<	0.000660	O	P	<	0.032000	M	Ta	<	0.000660			
O	Be	<	0.000082	M	Hg	<	0.002000	M	Pb	<	0.002300	M	Tb	<	0.000660			
M	Bi	<	0.006600	M	Ho	<	0.000660	M	Pd	<	0.000660	M	Te	<	0.017000			
O	Ca		0.031000	M	In	<	0.000660	M	Pr	<	0.000660	M	Th	<	0.000660			
O	Cd	<	0.000450	M	Ir	<	0.000660	M	Pt	<	0.002700	M	Ti	<	0.000660			
M	Ce	<	0.000660	s	K	<		M	Rb		0.480000	M	Tl	<	0.000660			
O	Co	<	0.000780	M	La	<	0.000660	M	Re	<	0.000660	M	Tm	<	0.000660			
O	Cr		0.000530	O	Li	<	0.000084	M	Rh	<	0.000660	M	U	<	0.000660			
M	Cs	<	0.000660	M	Lu	<	0.000660	M	Ru	<	0.000660	O	V	<	0.001100			
M	Cu	<	0.002700	O	Mg		0.006300	O	S		0.028000	M	W	<	0.000660			
M	Dy	<	0.000660	O	Mn		0.000480	M	Sb	<	0.000660	M	Y	<	0.000660			
M	Er	<	0.000660	M	Mo	<	0.000660	O	Sc	<	0.000340	O	Yb	<	0.000270			

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 39.10 +1 (6) K+(aq)
Chemical Compatibility -Soluble in HCl, HNO3, H2SO4 and HF aqueous matrices. Avoid use of HClO4 due to insolubility of the perchlorate. Stable with all metals and inorganic anions except ClO4-.
Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO3 / LDPE container.
K Containing Samples (Preparation and Solution) - Metal (Dissolves very rapidly in water); Ores (Sodium carbonate fusion in Pt0 followed by HCl dissolution-blank levels of K in sodium carbonate critical); Organic Matrices (Sulfuric/peroxide digestion)
Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 39 amu	10 ppt	n/a	38ArH, 23Na16O, 78Se
ICP-OES 404.721 nm	1.1 / 0.05 µg/mL	1	U, Ce
ICP-OES 766.490 nm	0.4 / 0.001 µg/mL	1	2nd order radiation from R.E.s on some optical designs
ICP-OES 771.531 nm	1.0 / 0.03 µg/mL	1	2nd order radiation from R.E.s on some optical designs

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

February 06, 2021

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **February 06, 2025**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Director, Quality Control

Certifying Officer:

Paul Gaines
Chairman / Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

tel: 800.669.6799 · 540.585.3030
fax: 540.585.3012
info@inorganicventures.com

1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGMG10
Lot Number:	R2-MG695748
Matrix:	2% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Magnesium
Starting Material:	Magnesium Metal
Starting Material Lot#:	2168
Starting Material Purity:	99.9984%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10044 ± 30 µg/mL

Density: 1.053 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10055 ± 26 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

Assay Method #2 **10042 ± 57 µg/mL**
ICP Assay NIST SRM 3131a Lot Number: 140110

Assay Method #3 **10033 ± 26 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Ag		0.002104	M	Eu	<	0.000910	O	Na		0.071011	O	Se	<	0.048000	O	Zn		0.003296
M	Al		0.003550	M	Fe		0.002536	M	Nb	<	0.000460	O	Si	<	0.032000	O	Zr	<	0.002700
M	As	<	0.001400	M	Ga	<	0.000460	M	Nd	<	0.000910	M	Sm	<	0.000460				
M	Au	<	0.001400	M	Gd	<	0.000460	O	Ni	<	0.001600	M	Sn	<	0.002300				
O	B		0.006847	M	Ge	<	0.001400	M	Os	<	0.000460	O	Sr		0.000278				
O	Ba		0.000963	M	Hf	<	0.000460	O	P		0.015216	M	Ta	<	0.000460				
O	Be	<	0.000120	M	Hg	<	0.000460	M	Pb	<	0.000460	M	Tb	<	0.000460				
M	Bi	<	0.000460	M	Ho	<	0.000460	M	Pd	<	0.003200	M	Te	<	0.007300				
O	Ca		0.053258	M	In	<	0.000460	M	Pr	<	0.000460	M	Th	<	0.000460				
O	Cd	<	0.000360	M	Ir	<	0.000460	M	Pt	<	0.001900	O	Ti	<	0.001700				
M	Ce	<	0.002300	M	K		0.048186	M	Rb		0.002409	M	Tl		0.003043				
M	Co	<	0.000910	M	La	<	0.002800	M	Re	<	0.000460	M	Tm	<	0.000460				
M	Cr	<	0.002300	O	Li		0.027897	M	Rh	<	0.000460	M	U	<	0.000460				
M	Cs		0.001039	M	Lu	<	0.000460	M	Ru	<	0.000460	M	V	<	0.000460				
O	Cu	<	0.003000	s	Mg	<		O	S	<	0.190000	M	W	<	0.000460				
M	Dy	<	0.000460	O	Mn		0.015216	M	Sb		0.020796	O	Y	<	0.000720				
M	Er	<	0.000460	M	Mo	<	0.000910	O	Sc	<	0.000480	M	Yb	<	0.000460				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 24.31 +2 6 $Mg(H_2O)_6^{+2}$

Chemical Compatibility -Soluble in HCl, HNO_3, and H_2SO_4 avoid HF, H_3PO_4 and neutral to basic media. Stable with most metals and inorganic anions forming insoluble silicates, carbonates, hydroxides, oxides, and tungstates in neutral and slightly acidic media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-10% HNO_3 / LDPE container.

Mg Containing Samples (Preparation and Solution) -Metal (Best dissolved in diluted HNO_3); Oxide (Readily soluble in above compatible aqueous acidic solutions); Ores (Carbonate fusion in Pt0 followed by HCl dissolution); Organic Matrices (Sulfuric / peroxide digestion or nitric / sulfuric / perchloric acid decomposition, or dry ash and dissolution in dilute HCl).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 24 amu	42 ppt	n/a	$^{7}Li^{17}O$, $^{48}Ti^{+2}$, $^{48}Ca^{+2}$
ICP-OES 279.553 nm	0.0002 / 0.00003 µg/mL	1	Th
ICP-OES 280.270 nm	0.0003 / 0.00005 µg/mL	1	U, V
ICP-OES 285.213 nm	0.002 / 0.00003 µg/mL	1	U, Hf, Cr, Zr

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

Inorganic Ventures, 300 Technology Drive, Christiansburg, Va. 24073, USA; Telephone: 800.669.6799; 540.585.3030, Fax: 540.585.3012; inorganicventures.com; info@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

September 01, 2020

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **September 01, 2024**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Director, Quality Control

Certifying Officer:

Paul Gaines
Chairman / Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

tel: 800.669.6799 · 540.585.3030
fax: 540.585.3012
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1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGMN10
Lot Number:	P2-MN687536
Matrix:	3% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Manganese
Starting Material:	Mn Metal
Starting Material Lot#:	2275
Starting Material Purity:	99.9909%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10046 ± 30 µg/mL

Density: 1.035 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10045 ± 25 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

Assay Method #2 **10083 ± 68 µg/mL**
ICP Assay NIST SRM 3132 Lot Number: 050429

Assay Method #3 **10031 ± 47 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\ (u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\ (u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.001500	M	Eu	<	0.000730	O	Na		0.176713	M	Se	<	0.006600	M	Zn		0.009960
O	Al		0.004337	M	Fe	<	0.650000	M	Nb	<	0.000730	O	Si		0.097995	M	Zr	<	0.000730
M	As	<	0.008000	M	Ga		0.004337	M	Nd	<	0.001500	M	Sm	<	0.000730				
M	Au	<	0.000730	M	Gd	<	0.000730	M	Ni		0.024097	M	Sn	<	0.002200				
M	B		0.069078	M	Ge	<	0.004400	M	Os	<	0.000730	O	Sr		0.000931				
M	Ba	<	0.001500	M	Hf	<	0.000730	i	P	<		M	Ta	<	0.000730				
M	Be	<	0.000730	M	Hg	<	0.002200	M	Pb		0.007389	M	Tb	<	0.000730				
M	Bi	<	0.003000	M	Ho	<	0.000730	M	Pd	<	0.000730	M	Te	<	0.019000				
O	Ca		0.062652	M	In	<	0.003000	M	Pr	<	0.000730	M	Th	<	0.000730				
M	Cd	<	0.001500	M	Ir	<	0.000730	M	Pt	<	0.000730	O	Ti	<	0.006500				
M	Ce	<	0.007300	O	K		0.006425	M	Rb	<	0.006600	M	Tl	<	0.000730				
O	Co		0.014779	M	La	<	0.003000	M	Re	<	0.000730	M	Tm	<	0.000730				
O	Cr		0.273102	O	Li		0.000417	M	Rh	<	0.003000	M	U	<	0.001500				
M	Cs	<	0.000730	M	Lu	<	0.000730	M	Ru	<	0.004400	M	V	<	0.000730				
O	Cu		0.007711	O	Mg		0.321297	i	S	<		M	W	<	0.004400				
M	Dy	<	0.001500	s	Mn	<		M	Sb	<	0.021000	O	Y		0.001365				
M	Er	<	0.001500	M	Mo		0.010281	O	Sc	<	0.004100	M	Yb	<	0.000730				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 54.94 +2 6 $Mn(H_2O)_6^{2+}$

Chemical Compatibility -Stable in HCl, HNO_3, H_2SO_4 ,HF, H_3PO_4. Avoid basic media. Stable with most metals and inorganic anions in acidic media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5 % HNO_3/LDPE container.

Mn Containing Samples (Preparation and Solution) -Metal (Soluble in dilute acids); Oxides (Soluble in dilute acids); Ores (Dissolve with HCl. If silica is present add HF and then fume off silica by adding H_2SO_4 and heat to SO_3 fumes - dense white fumes).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 55 amu	10 ppt	n/a	40Ar14N1H,39K16O,37Cl18O,40Ar15N,38Ar17O,36Ar18O1H ,38Ar16O1H,37Cl17O1H,23Na32S
ICP-OES 257.610 nm	0.0014 / 0.00002 µg/mL	1	Ce, W, Re
ICP-OES 259.373 nm	0.0016 / 0.00002 µg/mL	1	U, Ta, Mo, Fe, Nb
ICP-OES 260.569 nm	0.0021 / 0.00002 µg/mL	1	Co

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

January 05, 2020

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **January 05, 2024**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
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CERTIFICATE OF ANALYSIS

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1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGMO10
Lot Number:	R2-MO693167
Matrix:	tr. NH_4OH H_2O
Value / Analyte(s):	10 000 µg/mL ea: Molybdenum
Starting Material:	Ammonium Molybdate
Starting Material Lot#:	2257
Starting Material Purity:	99.9914%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10013 ± 35 µg/mL

Density: 1.011 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10035 ± 67 µg/mL**
ICP Assay NIST SRM 3134 Lot Number: 130418

Assay Method #2 **10005 ± 40 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.001826	M	Eu	<	0.000300	M	Na		0.008750	M	Se	<	0.007480	M	Zn		0.002553
M	Al		0.004455	M	Fe		0.002093	M	Nb	<	0.015030	i	Si	<		M	Zr	<	0.005393
M	As	<	0.003006	M	Ga	<	0.000300	i	Nd	<		M	Sm	<	0.000300				
M	Au	<	0.006012	M	Gd	<	0.000300	M	Ni	<	0.004828	M	Sn		0.001004				
M	B	<	0.035184	M	Ge	<	0.000903	M	Os	<	0.003006	M	Sr		0.001903				
O	Ba		0.015613	M	Hf	<	0.000896	i	P	<		M	Ta	<	0.000300				
M	Be	<	0.003006	M	Hg	<	0.003006	M	Pb	<	0.000409	M	Tb	<	0.000300				
M	Bi	<	0.000401	M	Ho	<	0.000300	M	Pd	<	0.001114	M	Te	<	0.060122				
O	Ca		0.032589	M	In	<	0.015030	M	Pr	<	0.090184	M	Th	<	0.000786				
O	Cd	<	0.051800	M	Ir	<	0.007483	M	Pt	<	0.000388	O	Ti	<	0.093240				
M	Ce	<	0.015030	M	K		1.114508	M	Rb		0.040641	M	Tl		0.013140				
M	Co		0.004032	M	La	<	0.000300	M	Re	<	0.000300	M	Tm	<	0.000300				
M	Cr		0.005931	O	Li		0.000215	M	Rh	<	0.000300	M	U		0.000937				
M	Cs		0.002812	M	Lu	<	0.000300	M	Ru	<	0.003006	M	V	<	0.000759				
M	Cu		0.005172	M	Mg		0.005212	i	S	<		M	W		0.592427				
M	Dy	<	0.000300	M	Mn		0.000952	M	Sb		0.003147	M	Y	<	0.000300				
M	Er	<	0.000300	s	Mo	<		M	Sc	<	0.009019	M	Yb	<	0.000300				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 95.94 +6 6,7,8,9 [MoO4] -2(chemical form as received)

Chemical Compatibility -Mo is received in a NH4OH matrix giving the operator the option of using HCl or HF to stabilize acidic solutions. The [MoO4]-2 is soluble in concentrated HCl [MoOCl5]-2, dilute HF / HNO3 [MoOF5] -2 and basic media [MoO4]-2. Stable at ppm levels with some metals provided it is fluorinated. Do not mix with Alkaline or Rare Earths when HF is present. Stable with most inorganic anions provided it is in the [MoO4]-2 chemical form.

Stability - 2-100 ppb levels stable (alone or mixed with all other metals that are at comparable levels) as the [MoOF5]-2 for months in 1% HNO3 / LDPE container. 1-10,000 ppm single element solutions as the [MoO4] -2 chemically stable for years in 1% NH4OH in a LDPE container.

Mo Containing Samples (Preparation and Solution) -Metal (Soluble in HF / HNO3 or hot dilute HCl); Oxide (soluble in HF or NH4OH) ; Organic Matrices (Dry ash at 450EC in Pt0 and dissolve oxide with HF or HCl).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 95 amu	3 ppt	n/a	40Ar39K16O,79Br16O,190Os2+,190Pt2+
ICP-OES 202.030 nm	0.008 / 0.0002 µg/mL	1	Os, Hf
ICP-OES 203.844 nm	0.012 / 0.002 µg/mL	1	
ICP-OES 204.598 nm	0.012 / 0.001 µg/mL	1	Ir, Ta

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

May 28, 2020

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **May 28, 2024**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com
tel: 800.669.6799 · 540.585.3030
fax: 540.585.3012
info@inorganicventures.com

CERTIFICATE OF ANALYSIS

1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGNA10
Lot Number:	S2-NA700842
Matrix:	2% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Sodium
Starting Material:	Na2CO3
Starting Material Lot#:	2274
Starting Material Purity:	99.9958%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10053 ± 30 µg/mL

Density: 1.036 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10070 ± 26 µg/mL**
Gravimetric NIST SRM Lot Number: See Sec. 4.2

Assay Method #2 **10012 ± 31 µg/mL**
ICP Assay NIST SRM 3152a Lot Number: 120715

Assay Method #3 **10059 ± 20 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

O	Ag	<	0.000250	M	Eu	<	0.000840	s	Na	<		O	Se	<	0.004700	O	Zn	0.000226
O	Al		0.003688	O	Fe		0.001560	O	Nb	<	0.001300	O	Si		0.049648	O	Zr	0.000680
O	As	<	0.006900	M	Ga	<	0.000840	M	Nd	<	0.000840	M	Sm	<	0.000840			
M	Au	<	0.000840	M	Gd	<	0.000840	O	Ni	<	0.000250	M	Sn	<	0.001700			
O	B		0.000936	M	Ge	<	0.003400	M	Os	<	0.000840	O	Sr		0.000255			
O	Ba		0.002269	M	Hf	<	0.000840	O	P		0.006525	M	Ta	<	0.004200			
O	Be	<	0.000130	M	Hg	<	0.001700	M	Pb	<	0.000840	M	Tb	<	0.000840			
O	Bi	<	0.008100	M	Ho	<	0.000840	M	Pd	<	0.000840	O	Te	<	0.004800			
O	Ca		0.085112	M	In	<	0.000840	M	Pr	<	0.000840	M	Th	<	0.002500			
O	Cd	<	0.000250	M	Ir	<	0.000840	M	Pt	<	0.000840	O	Ti		0.000553			
M	Ce	<	0.001700	O	K		1.049718	M	Rb	<	0.003400	M	Tl	<	0.000840			
O	Co	<	0.000370	M	La	<	0.000840	M	Re	<	0.000840	M	Tm	<	0.000840			
O	Cr	<	0.001400	O	Li		0.000069	M	Rh	<	0.000840	M	U	<	0.000840			
M	Cs	<	0.003400	M	Lu	<	0.000840	M	Ru	<	0.001700	O	V	<	0.001600			
O	Cu	<	0.001400	O	Mg		0.028370	O	S		0.048230	O	W	<	0.005000			
M	Dy	<	0.000840	O	Mn		0.000139	M	Sb	<	0.001700	O	Y	<	0.000730			
M	Er	<	0.000840	O	Mo	<	0.004800	O	Sc	<	0.000370	O	Yb	<	0.000130			

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 22.99 +1 (6) Na+(aq) largely ionic in nature

Chemical Compatibility -Soluble in HCl, HNO3, H2SO4 and HF aqueous matrices. Stable with all metals and inorganic anions.

Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO3 / LDPE container.

Na Containing Samples (Preparation and Solution) - Metal (Dissolves very rapidly in water); Ores (Lithium carbonate fusion in graphite crucible followed by HCl dissolution - blank levels of Na in lithium carbonate critical); Organic Matrices (Sulfuric / peroxide digestion or nitric/sulfuric/perchloric acid decomposition).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 23 amu	310 ppt	n/a	46Ti+2 , 46Ca+2
ICP-OES 330.237 nm	2.0 / 0.09 µg/mL	1	Pd, Zn
ICP-OES 588.995 nm	0.03 / 0.006 µg/mL	1	2nd order radiation from R.E.s on some optical designs
ICP-OES 589.595 nm	0.07 / 0.00009 µg/mL	1	2nd order radiation from R.E.s on some optical designs

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

January 25, 2021

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **January 25, 2025**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Director, Quality Control

Certifying Officer:

Paul Gaines
Chairman / Senior Technical Director

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info@inorganicventures.com

CERTIFICATE OF ANALYSIS

1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED Testing Laboratory Certificate 883.01
ACCREDITED Reference Material Producer Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGNI10
Lot Number:	P2-NI686384
Matrix:	3% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Nickel
Starting Material:	Ni Metal
Starting Material Lot#:	2277 and 2282
Starting Material Purity:	99.9992%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 9979 ± 30 µg/mL

Density: 1.038 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **9971 ± 54 µg/mL**
ICP Assay NIST SRM 3136 Lot Number: 120619

Assay Method #2 **9970 ± 32 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

Assay Method #3 **9993 ± 33 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\ (u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\ (u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag		0.002606	M	Eu	<	0.001100	O	Na		0.004965	O	Se	<	0.067000	M	Zn		0.006578
M	Al	<	0.013000	O	Fe		0.018618	M	Nb	<	0.001100	O	Si		0.010923	M	Zr	<	0.001100
O	As	<	0.067000	M	Ga	<	0.001100	M	Nd	<	0.001100	M	Sm	<	0.001100				
M	Au	<	0.002100	M	Gd	<	0.001100	s	Ni	<		M	Sn	<	0.016000				
M	B	<	0.017000	M	Ge	<	0.004200	M	Os		0.002110	O	Sr	<	0.000940				
M	Ba	<	0.001100	M	Hf	<	0.001100	i	P	<		M	Ta	<	0.001100				
O	Be	<	0.000410	M	Hg		0.014895	M	Pb		0.006578	M	Tb	<	0.001100				
M	Bi	<	0.004200	M	Ho	<	0.001100	M	Pd	<	0.001100	M	Te	<	0.015000				
O	Ca		0.003351	M	In	<	0.001100	M	Pr	<	0.001100	M	Th	<	0.001100				
M	Cd		0.001365	M	Ir		0.004716	M	Pt	<	0.001100	M	Ti	<	0.004200				
M	Ce	<	0.001100	O	K		0.004716	M	Rb	<	0.001100	M	Tl	<	0.001100				
O	Co		0.017377	M	La	<	0.001100	M	Re		0.001737	M	Tm	<	0.001100				
O	Cr	<	0.006700	O	Li	<	0.000140	M	Rh	<	0.006300	M	U	<	0.001100				
M	Cs	<	0.007300	M	Lu	<	0.001100	M	Ru	<	0.019000	M	V	<	0.002100				
M	Cu		0.004096	O	Mg		0.000372	i	S	<		M	W	<	0.006300				
M	Dy	<	0.001100	O	Mn	<	0.001900	M	Sb		0.005833	O	Y	<	0.000540				
M	Er	<	0.001100	M	Mo	<	0.008400	M	Sc	<	0.002100	M	Yb	<	0.001100				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 58.69 +2 6 Ni(H2O)62+
Chemical Compatibility -Stable in HCl, HNO3, H2SO4 ,HF, H3PO4. Avoid basic media. Stable with most metals and inorganic anions in acidic media.
Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO3 / LDPE container.
Ni Containing Samples (Preparation and Solution) -Metal (Soluble in HNO3); Oxides (Soluble in HCl); Ores (Dissolve in HCl / HNO3).
Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 60 amu	100 ppt	n/a	43Ca16O1H , 44Ca16O, 23Na37Cl
ICP-OES 221.647 nm	0.01 / 0.0009 µg/mL	1	Si
ICP-OES 231.604 nm	0.02 / 0.002 µg/mL	1	Sb, Ta, Co
ICP-OES 232.003 nm	0.02 / 0.006 µg/mL	1	Cr, Re, Os, Nb, Ag, Pt, Fe

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

December 02, 2019

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **December 02, 2023**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

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1.0 ACCREDITATION / REGISTRATION

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ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGPB10
Lot Number:	P2-PB686383
Matrix:	0.5% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Lead
Starting Material:	Lead Nitrate
Starting Material Lot#:	2299
Starting Material Purity:	99.9974%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10031 ± 30 µg/mL

Density: 1.015 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10060 ± 63 µg/mL**
ICP Assay NIST SRM 3128 Lot Number: 101026

Assay Method #2 **10048 ± 32 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

Assay Method #3 **10007 ± 32 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag		0.000850	M	Eu	<	0.000310	O	Na		0.005780	M	Se	<	0.004600	M	Zn		0.005440
O	Al		0.234602	O	Fe		0.023460	M	Nb	<	0.000310	O	Si		0.047600	M	Zr	<	0.000610
M	As	<	0.001900	M	Ga	<	0.000310	M	Nd	<	0.000310	M	Sm	<	0.000310				
M	Au	<	0.002200	M	Gd	<	0.004300	M	Ni	<	0.001600	M	Sn	<	0.000610				
O	B	<	0.005200	M	Ge	<	0.000610	M	Os	<	0.000310	O	Sr		0.000442				
O	Ba		0.001530	M	Hf	<	0.000310	O	P	<	0.052000	M	Ta	<	0.000310				
O	Be	<	0.000630	M	Hg	<	0.001600	s	Pb	<		M	Tb	<	0.000310				
O	Bi		0.021080	M	Ho	<	0.000610	M	Pd	<	0.000310	M	Te	<	0.004300				
O	Ca		0.037400	M	In	<	0.000310	M	Pr	<	0.000310	M	Th	<	0.000310				
M	Cd	<	0.000610	M	Ir	<	0.000310	M	Pt	<	0.000310	M	Ti		0.002992				
M	Ce	<	0.000910	O	K		0.008840	M	Rb	<	0.000610	M	Tl		0.037400				
M	Co	<	0.000610	M	La	<	0.000610	M	Re	<	0.000310	M	Tm	<	0.000610				
M	Cr	<	0.003400	O	Li		0.000108	O	Rh	<	0.006300	M	U	<	0.000310				
M	Cs		0.002686	M	Lu	<	0.000310	M	Ru	<	0.000310	M	V	<	0.000310				
M	Cu	<	0.002500	O	Mg		0.004760	O	S	<	0.052000	M	W	<	0.002200				
M	Dy	<	0.000310	M	Mn	<	0.000310	M	Sb	<	0.001300	M	Y	<	0.000310				
M	Er	<	0.000310	O	Mo	<	0.005400	M	Sc	<	0.000310	M	Yb	<	0.000310				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 207.20 +2 6 $Pb(H_2O)_6^{+2}$

Chemical Compatibility - Soluble in HCl, HF and HNO_3. Avoid H_2SO_4. Stable with most metals and inorganic anions forming insoluble carbonate, borate, sulfate, sulfite, sulfide, phosphate, oxalate, chromate, tannate, iodate, and cyanide in neutral aqueous media.

Stability - 2-100 ppb levels stable for months in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 2-5% HNO_3 / LDPE container.

Pb Containing Samples (Preparation and Solution) -Metal (Best dissolved in 1:1 H_2O / HNO_3); Oxides (The many different Pb oxides are soluble in HNO_3 with the exception of PbO_2 which is soluble in HCl or HF); Ores and Alloys (Best attacked using 1:1 H_2O / HNO_3); Organic Matrices (Dry ash and dissolve in dilute HCl).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 208 amu	5 ppt	n/a	192Pt16O, 192Os16O
ICP-OES 168.215 nm	0.03 / 0.003 µg/mL	1	Co
ICP-OES 217.000 nm	0.09 / 0.03 µg/mL	1	W, Ir, Hf, Sb, Th
ICP-OES 220.353 nm	0.04 / 0.006 µg/mL	1	Bi, Nb

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

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11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

December 02, 2019

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **December 02, 2023**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

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1.0 ACCREDITATION / REGISTRATION

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ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGSB10
Lot Number:	R2-SB688559
Matrix:	3% (v/v) HNO3 3% (w/v) tartaric acid
Value / Analyte(s):	10 000 µg/mL ea: Antimony
Starting Material:	Antimony Metal
Starting Material Lot#:	1857
Starting Material Purity:	99.9894%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10003 ± 47 µg/mL

Density: 1.061 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10003 ± 41 µg/mL**
ICP Assay NIST SRM 3102a Lot Number: 140911

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

$CRM/RM\ Expanded\ Uncertainty\ (\pm) = U_{CRM/RM} = k\ (u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\ (u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\ (u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

$CRM/RM\ Expanded\ Uncertainty\ (\pm) = U_{CRM/RM} = k\ (u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.000200	M	Eu	<	0.000300	O	Na		0.140000	M	Se	<	0.007300	O	Zn	0.005000
M	Al		0.003200	O	Fe		0.060000	M	Nb	<	0.000100	O	Si		0.150000	O	Zr	< 0.006300
M	As	<	0.004400	M	Ga	<	0.000400	M	Nd	<	0.000100	M	Sm	<	0.000100			
M	Au	<	0.000210	M	Gd	<	0.000100	O	Ni		0.004800	M	Sn	<	0.001800			
M	B	<	0.011000	M	Ge	<	0.000600	M	Os	<	0.000110	O	Sr		0.000750			
O	Ba	<	0.004900	M	Hf	<	0.000100	O	P		0.540000	M	Ta		0.003300			
M	Be	<	0.000400	M	Hg	<	0.000110	M	Pb	<	0.000400	M	Tb	<	0.000100			
M	Bi	<	0.000200	M	Ho	<	0.000100	M	Pd	<	0.000210	M	Te	<	0.000600			
O	Ca		0.110000	M	In	<	0.000100	M	Pr	<	0.001600	M	Th	<	0.000100			
M	Cd	<	0.000200	M	Ir	<	0.000110	M	Pt	<	0.000600	M	Ti	<	0.002800			
M	Ce		0.006500	O	K		0.020000	M	Rb	<	0.001000	M	Tl	<	0.000100			
M	Co	<	0.000200	O	La	<	0.016000	M	Re	<	0.000100	M	Tm	<	0.000100			
M	Cr		0.006900	O	Li	<	0.000430	M	Rh	<	0.000300	M	U	<	0.000100			
M	Cs	<	0.000200	M	Lu	<	0.000100	M	Ru	<	0.000310	M	V	<	0.000800			
M	Cu	<	0.000600	O	Mg		0.021000	n	S	<		M	W	<	0.000200			
M	Dy	<	0.000100	O	Mn		0.001900	s	Sb	<		M	Y	<	0.000100			
M	Er	<	0.000100	M	Mo	<	0.000500	O	Sc	<	0.002300	M	Yb	<	0.000100			

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 121.75 +3 6 Sb(O)C4H4O6-1

Chemical Compatibility -Stable in conc. HCl, dilute or conc. HF. Stable in dilute HNO3 as the fluoride or tartrate complex. Avoid basic media. Stable with most metals and inorganic anions in acidic media as the tartrate provided the acidity is not too high or the acid is oxidizing causing loss of the stabilizing tartrate ion. The fluoride complex of antimony is stable in strong acid but you should only mix with other metals that are fluorinated.

Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-2% HNO3 / LDPE container.

Sb Containing Samples (Preparation and Solution) -Metal and alloys (Soluble in H2O / HF / HNO3 mixture); Oxides (Soluble in HCl and tartaric acid or H2O / HF / HNO3 mixtures); Ores (fusion with Na2CO3 in Pt0 followed by dissolving the fuseate in a H2O / HF / HNO3 mixture); Organic based (sulfuric acid / hydrogen peroxide digestion)

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 121 amu	5 ppt	N/A	105Pd16O, 89Y16O2
ICP-OES 206.833 nm	0.03/0.003 µg/mL	1	Ta, Cr, Ge, Hf
ICP-OES 217.581 nm	0.05/0.005 µg/mL	1	Nb, W, Re, Fe
ICP-OES 231.147 nm	0.06/0.006 µg/mL	1	Ni, Co, Pt

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

April 30, 2020

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **April 30, 2024**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

tel: 800.669.6799 · 540.585.3030
fax: 540.585.3012
info@inorganicventures.com

1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGSE10
Lot Number:	P2-SE684206
Matrix:	3% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Selenium
Starting Material:	Se Metal
Starting Material Lot#:	1962
Starting Material Purity:	99.9991%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 9992 ± 61 µg/mL

Density: 1.035 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **9993 ± 67 µg/mL**
ICP Assay NIST SRM 3149 Lot Number: 100901

Assay Method #2 **9992 ± 73 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.002242	M	Eu	<	0.000373	O	Na		0.013700	s	Se	<		O	Zn		0.002382
M	Al		0.004465	M	Fe		0.008506	O	Nb	<	0.002975	O	Si		0.006270	M	Zr	<	0.001868
O	As	<	0.022040	M	Ga	<	0.000373	M	Nd	<	0.000373	M	Sm	<	0.000373				
M	Au	<	0.000373	M	Gd	<	0.000373	O	Ni		0.001849	M	Sn		0.000850				
O	B	<	0.007714	M	Ge	<	0.002616	M	Os	<	0.000373	M	Sr	<	0.001121				
M	Ba	<	0.001495	M	Hf	<	0.000373	O	P	<	0.022040	M	Ta	<	0.000373				
M	Be	<	0.001495	M	Hg	<	0.002240	M	Pb		0.006379	M	Tb	<	0.006353				
M	Bi	<	0.000373	M	Ho	<	0.000373	M	Pd	<	0.000373	M	Te	<	0.012707				
O	Ca		0.006552	M	In	<	0.000373	M	Pr	<	0.001495	M	Th	<	0.002990				
M	Cd		0.001169	M	Ir	<	0.000373	M	Pt	<	0.000373	M	Ti	<	0.003363				
M	Ce	<	0.000373	O	K		0.002006	M	Rb	<	0.001868	M	Tl		0.008613				
M	Co	<	0.000373	M	La	<	0.001121	M	Re	<	0.000373	M	Tm	<	0.000373				
M	Cr		0.002870	O	Li		0.000062	M	Rh	<	0.000373	M	U	<	0.000373				
M	Cs	<	0.001121	M	Lu	<	0.000373	M	Ru	<	0.001493	M	V	<	0.000747				
M	Cu	<	0.000747	O	Mg		0.001159	O	S		0.024674	M	W	<	0.002242				
M	Dy	<	0.000373	M	Mn	<	0.000373	M	Sb	<	0.002242	M	Y	<	0.000373				
M	Er	<	0.000373	O	Mo	<	0.003195	M	Sc	<	0.001121	M	Yb	<	0.000373				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 78.96 +4 6 H_2SeO_3

Chemical Compatibility -Soluble in HCl, HNO_3,H_3PO_4, H_2SO_4 and HF aqueous matrices and water. It is stable with most inorganic anions but many cationic metals form the insoluble selenites under pH neutral conditions. When fluorinated and/or under acidic conditions precipitation is typically not a problem at moderate to low concentrations.

Stability - 2-100 ppb levels stable for months alone or mixed with other elements at equivalent levels in 1% HNO_3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO_3 / LDPE container.

Se Containing Samples (Preparation and Solution) -Metal (soluble in HNO_3); Oxides (readily soluble in water); Minerals and alloys (acid digestion with HNO_3or HNO_3 / HF); Organic Matrices (acid digestion with hot concentrated H_2SO_4 accompanied by the careful dropwise addition of H_2O_2 until clear).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 82 amu	200 ppt	N/A	12C35Cl2
ICP-OES 196.026 nm	0.08/0.006 µg/mL	1	Fe
ICP-OES 203.985 nm	0.2/0.05 µg/mL	1	Sb, Ir, Cr, Ta
ICP-OES 206.279 nm	0.3/0.16 µg/mL	1	Cr, Pt

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

Inorganic Ventures, 300 Technology Drive, Christiansburg, Va. 24073, USA; Telephone: 800.669.6799; 540.585.3030, Fax: 540.585.3012; inorganicventures.com; info@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

September 13, 2019

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **September 13, 2023**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

tel: 800.669.6799 · 540.585.3030
fax: 540.585.3012
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1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGTL10
Lot Number:	R2-TL691937
Matrix:	5% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Thallium
Starting Material:	TlNO3
Starting Material Lot#:	2118
Starting Material Purity:	99.9998%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 9987 ± 49 µg/mL

Density: 1.035 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **9968 ± 68 µg/mL**
ICP Assay NIST SRM 3158 Lot Number: 151215

Assay Method #2 **10001 ± 58 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The follow ing equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.000200	M	Eu	<	0.000200	O	Na		0.002479	M	Se	<	0.011019	O	Zn		0.002288
O	Al	<	0.004184	O	Fe	<	0.002824	M	Nb	<	0.000200	O	Si		0.003744	M	Zr	<	0.000200
M	As	<	0.002003	M	Ga	<	0.000200	M	Nd	<	0.000200	M	Sm	<	0.000200				
O	Au	<	0.002824	M	Gd	<	0.000200	M	Ni		0.001717	M	Sn	<	0.000601				
O	B	<	0.004184	M	Ge	<	0.000801	M	Os	<	0.000198	O	Sr	<	0.000313				
M	Ba	<	0.000400	M	Hf	<	0.000200	O	P	<	0.010460	M	Ta	<	0.000200				
O	Be	<	0.000104	M	Hg	<	0.000794	M	Pb		0.000807	M	Tb	<	0.000200				
M	Bi	<	0.005209	M	Ho	<	0.000200	M	Pd	<	0.000400	M	Te	<	0.005008				
O	Ca		0.002426	M	In	<	0.000200	M	Pr	<	0.000200	M	Th	<	0.000200				
M	Cd		0.001312	M	Ir	<	0.000198	M	Pt	<	0.000801	O	Ti	<	0.001255				
M	Ce	<	0.000200	O	K		0.006150	M	Rb	<	0.000200	s	Tl	<					
M	Co	<	0.000601	M	La	<	0.000200	M	Re	<	0.000200	M	Tm	<	0.000200				
M	Cr	<	0.000801	O	Li	<	0.000177	M	Rh	<	0.000200	M	U	<	0.000200				
M	Cs	<	0.003606	M	Lu	<	0.000200	M	Ru	<	0.000397	M	V	<	0.002203				
M	Cu	<	0.001001	O	Mg		0.000527	O	S	<	0.015690	M	W	<	0.000601				
M	Dy	<	0.000200	M	Mn	<	0.000801	M	Sb	<	0.000400	M	Y	<	0.000200				
M	Er	<	0.000200	M	Mo	<	0.001202	O	Sc	<	0.000711	M	Yb	<	0.000200				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 204.38 +1 6 Tl(H2O)61+

Chemical Compatibility - Soluble in HCl, HNO3, and H2SO4. Stable with most metals and inorganic anions. The sulfite, thiocyanate and oxalate are moderately soluble; the phosphate and arsenite are slightly soluble and the sulfide is insoluble.

Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 2-5% HNO3 / LDPE container.

Tl Containing Samples (Preparation and Solution) -Metal (Best dissolved in HNO3 which forms chiefly the Tl1+ ion.); Oxide (The thallous oxide is readily soluble in water. The thallic oxide requires high levels of acid); Ores (Carbonate fusion in Pt0 followed by HCl dissolution); Organic Matrices (Sulfuric/peroxide digestion or dry ash and dissolution in HCl).

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 205 amu	2 ppt	N/A	189Os16O
ICP-OES 190.864 nm	0.04 / 0.004 µg/mL	1	V, Ti
ICP-OES 276.787 nm	0.1 / 0.01 µg/mL	1	Ta, V, Fe, Cr
ICP-OES 351.924 nm	0.2 / 0.02 µg/mL	1	Th, Ce, Zr

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

Inorganic Ventures, 300 Technology Drive, Christiansburg, Va. 24073, USA; Telephone: 800.669.6799; 540.585.3030, Fax: 540.585.3012; inorganicventures.com; info@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

April 08, 2020

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **April 08, 2024**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

tel: 800.669.6799 · 540.585.3030
fax: 540.585.3012
info@inorganicventures.com

1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGV10
Lot Number:	R2-V688296
Matrix:	7% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Vanadium
Starting Material:	Vanadium pentoxide
Starting Material Lot#:	1782
Starting Material Purity:	99.9907%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10026 ± 30 µg/mL

Density: 1.105 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10025 ± 56 µg/mL**
ICP Assay NIST SRM 3165 Lot Number: 160906

Assay Method #2 **10027 ± 30 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.000510	M	Eu	<	0.000110	M	Na		0.095000	M	Se	<	0.002300	M	Zn		0.008900
O	Al		0.051000	O	Fe		0.350000	M	Nb	<	0.000710	O	Si		0.260000	M	Zr	<	0.002500
M	As	<	0.000410	M	Ga	<	0.007100	M	Nd	<	0.000210	M	Sm	<	0.000110				
M	Au	<	0.000410	M	Gd	<	0.000110	M	Ni		0.011000	M	Sn	<	0.003300				
M	B	<	0.006000	M	Ge	<	0.000110	M	Os	<	0.000410	M	Sr		0.001400				
M	Ba		0.001800	M	Hf	<	0.000110	O	P	<	0.120000	M	Ta	<	0.000110				
M	Be	<	0.000110	M	Hg	<	0.000310	M	Pb	<	0.002300	M	Tb	<	0.000110				
M	Bi	<	0.000610	M	Ho	<	0.000110	M	Pd	<	0.000610	M	Te	<	0.000610				
M	Ca		0.180000	M	In	<	0.000110	M	Pr	<	0.000110	M	Th	<	0.000210				
M	Cd	<	0.000410	M	Ir	<	0.000110	M	Pt	<	0.000410	M	Ti	<	0.021000				
M	Ce	<	0.000310	M	K		0.400000	M	Rb	<	0.000410	M	Tl	<	0.000110				
M	Co	<	0.001100	M	La	<	0.000110	M	Re	<	0.000110	M	Tm	<	0.000110				
O	Cr		0.190000	M	Li	<	0.001400	M	Rh	<	0.000110	M	U	<	0.000310				
M	Cs		0.005700	M	Lu	<	0.000110	M	Ru	<	0.000410	s	V	<					
M	Cu	<	0.001800	M	Mg		0.009200	n	S	<		M	W	<	0.003100				
M	Dy	<	0.000110	M	Mn		0.008700	M	Sb		0.076000	M	Y	<	0.000110				
M	Er	<	0.000110	M	Mo		0.086000	M	Sc	<	0.000310	M	Yb	<	0.000110				

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 50.94 +5 6 H2V10O284-

Chemical Compatibility -Soluble in HCl, HNO3, H2SO4, HF, H3PO4 and strong basic media. Stable with most metals and inorganic anions in acidic media.

Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO3 / LDPE container.

V Containing Samples (Preparation and Solution) -Metal (Fusion with NaOH or KOH in Ni0 or Na2CO3 / KNO3); Oxides (V2O3 - use HCl, V2O4 - use HCl or HNO3, V2O5 - use concentrated acids); Ores (Na2CO3 / KNO3 in Pt0 caution - nitrates attack Pto followed by water extraction of fuseate); Organic Matrices (Ash at 450 EC followed by dissolving according to V2O5 above) .

Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 51 amu	4 ppt	N/A	34S16O1H, 35Cl16O, 38Ar13C, 36Ar15N, 36Ar14N1H, 37Cl14N,36S15N, 33S18O, 34S17O, 102Ru+2,02Pd+2
ICP-OES 290.882 nm	0.008 / 0.0008 µg/mL	1	Hf, Nb
ICP-OES 292.402 nm	0.006 / 0.001 µg/mL	1	Th
ICP-OES 309.311 nm	0.005 / 0.001 µg/mL	1	Mg, U, Th

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

Inorganic Ventures, 300 Technology Drive, Christiansburg, Va. 24073, USA; Telephone: 800.669.6799; 540.585.3030, Fax: 540.585.3012; inorganicventures.com; info@inorganicventures.com

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

March 01, 2020

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **March 01, 2024**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

INORGANIC VENTURES
300 Technology Drive
Christiansburg, VA 24073 · USA
inorganicventures.com

CERTIFICATE OF ANALYSIS

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1.0 ACCREDITATION / REGISTRATION

INORGANIC VENTURES is accredited to ISO 17034, "General Requirements for the Competence of Reference Material Producers" and ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories". Inorganic Ventures is also an ISO 9001 registered manufacturer (QSR Certificate Number QSR-1034).

ACCREDITED
Testing Laboratory
Certificate 883.01

ACCREDITED
Reference Material Producer
Certificate 883.02

2.0 PRODUCT DESCRIPTION

Product Code:	Single Analyte Custom Grade Solution
Catalog Number:	CGZN10
Lot Number:	P2-ZN686137
Matrix:	2% (v/v) HNO3
Value / Analyte(s):	10 000 µg/mL ea: Zinc
Starting Material:	Zn Shot
Starting Material Lot#:	2201
Starting Material Purity:	99.9993%

3.0 CERTIFIED VALUES AND UNCERTAINTIES

Certified Value: 10040 ± 30 µg/mL

Density: 1.033 g/mL (measured at 20 ± 4 ºC)

Assay Information:

Assay Method #1 **10009 ± 54 µg/mL**
ICP Assay NIST SRM 3168a Lot Number: 120629

Assay Method #2 **10049 ± 33 µg/mL**
EDTA NIST SRM 928 Lot Number: 928

Assay Method #3 **10041 ± 28 µg/mL**
Calculated NIST SRM Lot Number: See Sec. 4.2

- The Calculated Value is a value calculated from the weight of a starting material that has been certified directly vs. a National Institute of Standards and Technology (NIST) SRM/RM. See Sec 4.2 for balance traceability.

The following equations are used in the calculation of the certified value and the uncertainty. Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Characterization of CRM/RM by Two or More Methods

Certified Value, $X_{CRM/RM}$, where two or more methods of characterization are used is the weighted mean of the results:

$X_{CRM/RM} = \Sigma(w_i)(X_i)$

X_i = mean of Assay Method i with standard uncertainty $u_{char\ i}$

w_i = the weighting factors for each method calculated using the inverse square of the variance:

$w_i = (1/u_{char\ i})^2 / (\Sigma(1/(u_{char\ i})^2)$

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char} = [\Sigma((w_i)^2\,(u_{char\ i})^2)]^{½}$ where $u_{char\ i}$ are the errors from each characterization method

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

Characterization of CRM/RM by One Method

Certified Value, $X_{CRM/RM}$, where one method of characterization is used is the mean of individual results:

$X_{CRM/RM} = (X_a)\,(u_{char\ a})$

X_a = mean of Assay Method A with

$u_{char\ a}$ = the standard uncertainty of characterization Method A

CRM/RM Expanded Uncertainty (±) = $U_{CRM/RM} = k\,(u^2_{char\ a} + u^2_{bb} + u^2_{lts} + u^2_{ts})^{½}$

k = coverage factor = 2

$u_{char\ a}$ = the errors from characterization

u_{bb} = bottle to bottle homogeneity standard uncertainty

u_{lts} = long term stability standard uncertainty (storage)

u_{ts} = transport stability standard uncertainty

4.0 TRACEABILITY TO NIST

- This product is traceable to NIST via an unbroken chain of comparisons. The uncertainties for each certified value are reported, taking into account the SRM/RM uncertainty error and the measurement, weighing and volume dilution errors. In rare cases where no NIST SRM/RM are available, the term 'in-house std.' is specified.

4.1 Thermometer Calibration

- All thermometers are NIST traceable through thermometers that are calibrated by an accredited calibration laboratory.

4.2 Balance Calibration

- All analytical balances are calibrated by an accredited calibration laboratory and procedure. The weights used for testing are annually compared to master weights and are traceable to NIST.

4.3 Glassware Calibration

- An in-house procedure is used to calibrate all Class A glassware used in the manufacturing and quality control of CRM/RMs.

5.0 TRACE METALLIC IMPURITIES (TMI) DETERMINED BY ICP-MS AND ICP-OES (µg/mL)

CRM/RMs are tested for trace metallic impurities by Axial ICP-OES and ICP-MS. The result from the most sensitive method for each element, is reported below. Solutions tested by ICP-MS were analyzed in an ULPA-Filtered Clean Room. An ULPA-Filter is 99.9985% efficient for the removal of particles down to 0.3 µm.

M	Ag	<	0.003057	M	Eu	<	0.000509	O	Na		0.001874	M	Se	<	0.023441	s	Zn	<
O	Al	<	0.005720	O	Fe		0.006348	M	Nb	<	0.000509	O	Si	<	0.057200	M	Zr	< 0.000509
M	As	<	0.003057	M	Ga	<	0.007134	M	Nd	<	0.000509	M	Sm	<	0.000509			
M	Au	<	0.000510	M	Gd	<	0.000509	M	Ni	<	0.000509	M	Sn	<	0.000509			
O	B	<	0.017160	M	Ge	<	0.003057	M	Os	<	0.000510	M	Sr	<	0.000509			
M	Ba	<	0.000509	M	Hf	<	0.000509	O	P	<	0.057200	M	Ta	<	0.000509			
M	Be	<	0.000509	M	Hg	<	0.001021	O	Pb		0.023870	M	Tb	<	0.000509			
M	Bi	<	0.005095	M	Ho	<	0.000509	M	Pd	<	0.002038	M	Te	<	0.023441			
O	Ca		0.033793	M	In	<	0.000509	M	Pr	<	0.000509	M	Th	<	0.000509			
O	Cd		0.003924	M	Ir	<	0.000510	M	Pt	<	0.000509	M	Ti	<	0.000509			
M	Ce	<	0.000509	O	K		0.001499	M	Rb	<	0.002038	M	Tl	<	0.009172			
M	Co	<	0.000509	M	La	<	0.000509	M	Re	<	0.000509	M	Tm	<	0.000509			
O	Cr		0.001549	O	Li	<	0.000457	M	Rh	<	0.000509	M	U	<	0.000509			
M	Cs	<	0.000509	M	Lu	<	0.000509	M	Ru	<	0.006129	M	V	<	0.000509			
O	Cu	<	0.010296	O	Mg		0.000349	O	S	<	0.034320	M	W	<	0.001019			
M	Dy	<	0.000509	M	Mn	<	0.000509	M	Sb	<	0.001019	M	Y	<	0.000509			
M	Er	<	0.000509	M	Mo	<	0.000509	M	Sc	<	0.000509	M	Yb	<	0.000509			

M - Checked by ICP-MS O - Checked by ICP-OES i - Spectral Interference
n - Not Checked For s - Solution Standard Element

6.0 INTENDED USE

- For the calibration of analytical instruments and validation of analytical methods as appropriate.

7.0 INSTRUCTIONS FOR THE CORRECT USE OF THIS REFERENCE MATERIAL

7.1 Storage and Handling Recommendations

- Store between approximately 4° - 30° C while in sealed TCT bag.

- While stored in the sealed TCT bag, transpiration of this CRM/RM is negligible. After opening the sealed TCT bag transpiration of the CRM/RM will occur, resulting in a gradual increase in the analyte concentration(s). It is the responsibility of the user to account for this effect. When the bottle is weighed both before and after being placed in storage, the mass difference observed will be a measure of transpiration mass loss.

- After opening the sealed TCT bag, keep cap tightly sealed when not in use and store between 4° - 24° C to minimize the effects of transpiration. Use at 20° ± 4° C to minimize volumetric dilution error when using the reported density. Do not pipette from the container. Do not return removed aliquots to container.

- For more information, visit **www.inorganicventures.com/TCT**

Atomic Weight; Valence; Coordination Number; Chemical Form in Solution - 65.39 +2 4 Zn(OH)(aq)1+
Chemical Compatibility -Stable in HCl, HNO3, H2SO4 ,HF, H3PO4. Avoid basic media forming insoluble carbonate and hydroxide. Stable with most metals and inorganic anions in acidic media.
Stability - 2-100 ppb levels stable for months in 1% HNO3 / LDPE container. 1-10,000 ppm solutions chemically stable for years in 1-5% HNO3 / LDPE container.
Zn Containing Samples (Preparation and Solution) -Metal (soluble in HNO3); Oxides (Soluble in HCl); Ores (Dissolve in HCl / HNO3); Organic based (dry ash at 4500C and dissolve ash in HCl) (sulfuric/peroxide acid digestion)
Atomic Spectroscopic Information (ICP-OES D.L.s are given as radial/axial view):

Technique/Line	**Estimated D.L.**	**Order**	**Interferences** (underlined indicates severe)
ICP-MS 66 amu	7 ppt	N/A	50Ti16O,50Cr16O, 50V16O, 34S16O2, 32S16O18O, 32S17O2, 33S16O17O, 32S34S, 33S2
ICP-OES 202.548 nm	0.004/0.0002 µg/mL	1	Nb, Cu, Co, Hf
ICP-OES 206.200 nm	0.006/0.0006 µg/mL	1	Sb, Ta, Bi, Os
ICP-OES 213.856 nm	0.002/0.0004 µg/mL	1	Ni, Cu, V

8.0 HAZARDOUS INFORMATION

- Please refer to the Safety Data Sheet for information regarding this CRM/RM.

9.0 HOMOGENEITY

- This solution was mixed according to an in-house procedure and is guaranteed to be homogeneous. Homogeneity data indicate that the end user should take a minimum sample size of 0.2 mL to assure homogeneity.

10.0 QUALITY STANDARD DOCUMENTATION

10.1 ISO 9001 Quality Management System Registration

- QSR Certificate Number QSR-1034

10.2 ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories"

- Chemical Testing - Accredited / A2LA Certificate Number 883.01

10.3 ISO 17034 "General Requirements for the Competence of Reference Material Producers"

- Reference Material Producer - Accredited / A2LA Certificate Number 883.02

11.0 CERTIFICATION, LOT EXPIRATION AND PERIOD OF VALIDITY

11.1 Certification Issue Date

December 05, 2019

- The certification is valid within the measurement uncertainty specified provided the CRM/RM is stored and handled in accordance with instructions given in Sec 7.1. This certification is nullified if instructions in Sec 7.1 are not followed or if the CRM/RM is damaged, contaminated, or otherwise modified.

11.2 Lot Expiration Date

- **December 05, 2023**

- The date after which this CRM/RM should not be used.

- The lot expiration date reflects the period of time that the stability of a CRM/RM can be supported by long term stability studies conducted on properly stored and handled CRM/RMs. Lot expiration is limited primarily by transpiration (loss of water from the solution) and infrequently by chemical stability.

11.3 Period of Validity

- Sealed TCT Bag Open Date: _____

- This CRM/RM should not be used longer than one year (or six months in the case of a 30 mL bottle) from the date of opening the aluminized bag or after the date given in Sec. 11.2, whichever comes first. This is contingent upon the CRM/RM being stored and handled in accordance with the instructions given in Sec. 7.1.

12.0 NAMES AND SIGNATURES OF CERTIFYING OFFICERS

Certificate Approved By:

Michael Booth
Manager, Quality Control

Certifying Officer:

Paul Gaines
CEO, Senior Technical Director

Lora Lake Apartments Site

2022 Annual Compliance Monitoring Report

Appendix C
Soil Cap and Wildlife Barrier Inspection Logs and Photographs

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2022 Annual Compliance Monitoring Report

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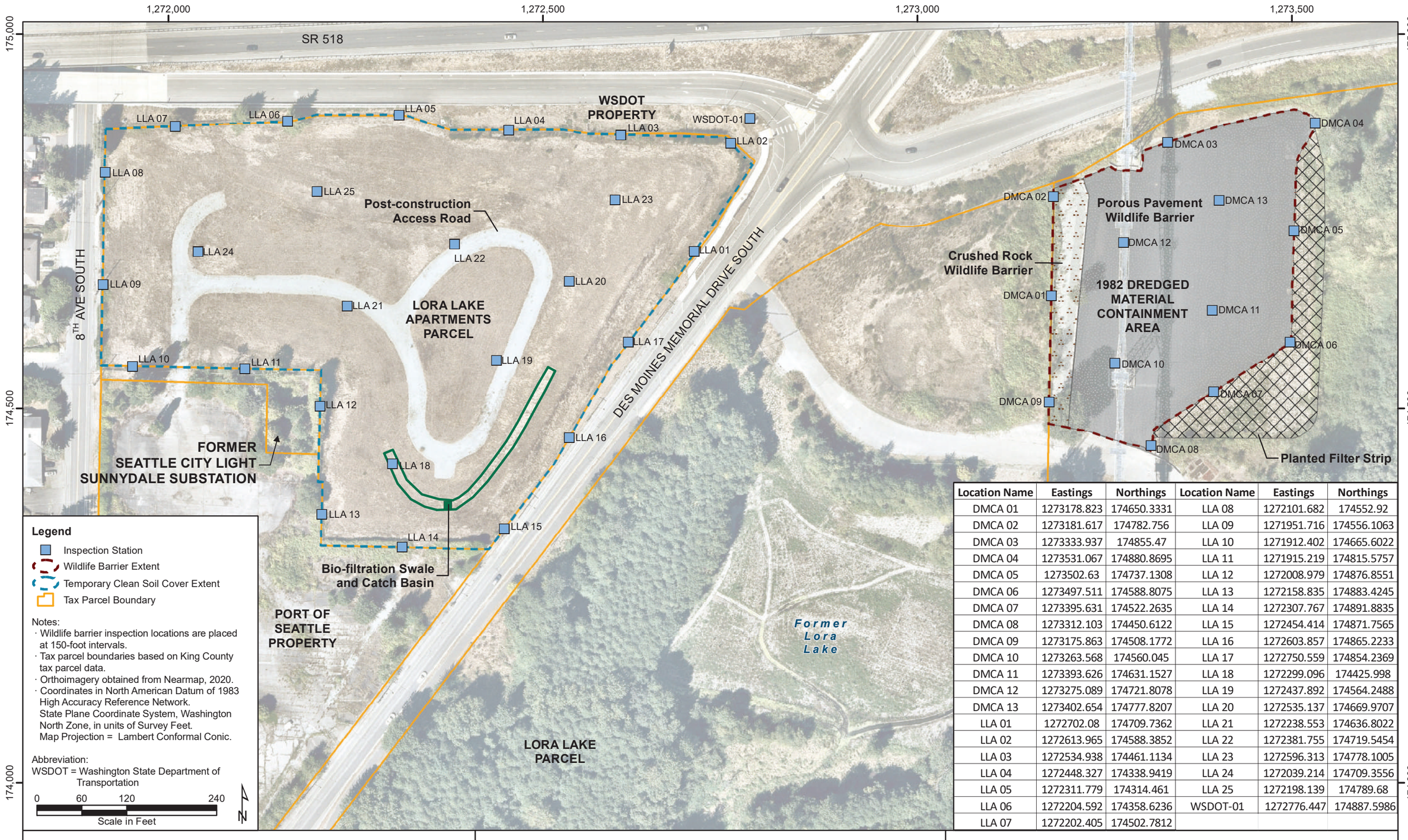
Figure



Legend

- Inspection Station
- Wildlife Barrier Extent
- Temporary Clean Soil Cover Extent
- Tax Parcel Boundary

Notes:

- Wildlife barrier inspection locations are placed at 150-foot intervals.
- Tax parcel boundaries based on King County tax parcel data.
- Orthoimagery obtained from Nearmap, 2020.
- Coordinates in North American Datum of 1983 High Accuracy Reference Network. State Plane Coordinate System, Washington North Zone, in units of Survey Feet. Map Projection = Lambert Conformal Conic.

Abbreviation:
WSDOT = Washington State Department of Transportation

0 60 120 240
Scale in Feet

N

Location Name	Eastings	Northings	Location Name	Eastings	Northings
DMCA 01	1273178.823	174650.3331	LLA 08	1272101.682	174552.92
DMCA 02	1273181.617	174782.756	LLA 09	1271951.716	174556.1063
DMCA 03	1273333.937	174855.47	LLA 10	1271912.402	174665.6022
DMCA 04	1273531.067	174880.8695	LLA 11	1271915.219	174815.5757
DMCA 05	1273502.63	174737.1308	LLA 12	1272008.979	174876.8551
DMCA 06	1273497.511	174588.8075	LLA 13	1272158.835	174883.4245
DMCA 07	1273395.631	174522.2635	LLA 14	1272307.767	174891.8835
DMCA 08	1273312.103	174450.6122	LLA 15	1272454.414	174871.7565
DMCA 09	1273175.863	174508.1772	LLA 16	1272603.857	174865.2233
DMCA 10	1273263.568	174560.045	LLA 17	1272750.559	174854.2369
DMCA 11	1273393.626	174631.1527	LLA 18	1272299.096	174425.998
DMCA 12	1273275.089	174721.8078	LLA 19	1272437.892	174564.2488
DMCA 13	1273402.654	174777.8207	LLA 20	1272535.137	174669.9707
LLA 01	1272702.08	174709.7362	LLA 21	1272238.553	174636.8022
LLA 02	1272613.965	174588.3852	LLA 22	1272381.755	174719.5454
LLA 03	1272534.938	174461.1134	LLA 23	1272596.313	174778.1005
LLA 04	1272448.327	174338.9419	LLA 24	1272039.214	174709.3556
LLA 05	1272311.779	174314.461	LLA 25	1272198.139	174789.68
LLA 06	1272204.592	174358.6236	WSDOT-01	1272776.447	174887.5986
LLA 07	1272202.405	174502.7812			

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Lora Lake Apartments Site
Burien, Washington

Figure C.1
Wildlife Barrier Inspection Locations

I:\GIS\Projects\POS_LLA\MXD\Task8140\Annual Compliance Monitoring Report\2022\Appendix C\Figure C.1 Wildlife Barrier Inspection Locations.mxd
10/17/2022

Lora Lake Apartments Site

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Appendix C
Soil Cap and Wildlife Barrier Inspection Logs and Photographs

Attachment C.1
Lora Lake Apartments Parcel Inspection Log and Photographs

Lora Lake Apartments Temporary Cap Inspection Form

Monitoring Station	Photo Number	Check all that apply						Overall Condition of Barrier			Repair Needed		Comments/Observations
		Engineered surface characteristics condition compromised	Exposed underlying soil	Loss of barrier material	Down-slope movement of barrier material	Presence of debris on barrier surface	Substantial plant growth	Good	Fair	Poor	Yes	No	
LLA 01								x				x	
LLA 02								x				x	
LLA 03								x				x	
LLA 04	L1		x						x		x		Loss of vegetation used for erosion control
LLA 05	L2		x						x		x		
LLA 06							x		x			x	Some maintenance of plant overgrowth recommended
LLA 07	L3						x		x			x	
LLA 08	L3, L4						x		x			x	
LLA 09	L4						x		x			x	
LLA 10	L5						x		x			x	
LLA 11								x				x	
LLA 12	L6,L7								x		x		Fence repair required
LLA 13								x				x	
LLA 14	L8		x						x		x		Loss of vegetation used for erosion control
LLA 15	L8		x							x	x		
LLA 16								x				x	
LLA 17								x				x	
LLA 18	L6		x							x	x		Loss of vegetation used for erosion control
LLA 19								x				x	
LLA 20								x				x	
LLA 21								x				x	
LLA 22								x				x	
LLA 23	L9		x	x					x			x	Animal burrowing
LLA 24								x				x	
LLA 25								x				x	
LLA 26								x				x	
LLA 27								x				x	
WSDOT 01	L10						x		x			x	Some maintenance of plant overgrowth recommended

Photograph L1. Station LLA 04 at the northeast corner of the property with slight loss of vegetation used for erosion control.

Photograph L2. Stations LLA 05 at the northeast corner of the property with slight loss of vegetation used for erosion control.

Photograph L3. Station LLA 07 and LLA 08, at the northwest corner of the property, with notable plant overgrowth.

Photograph L4. Stations LLA 08 and LLA 09, along the west property line, with notable plant overgrowth.

Photograph L5. Notable plant overgrowth at Station LLA 10, located at the southwest corner of the property.

Photograph L6. Large area at the southwest portion of the property near Stations LLA 12 and LLA 18 with noted loss of vegetation used for erosion control.

Photograph L7. Removed fence panel near Station LLA 12.

Photograph L8. Area just south of the biofiltration swale at the south end of the property, near Stations LLA 14 and LLA 15, with substantial loss of vegetation resulting in exposed underlying soils.

Photograph L9. Animal burrowing observed at the northeast corner of the property near Station LLA 23.

L10. Fair conditions with some plant overgrowth at Station WSDOT-10.

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Appendix C
Soil Cap and Wildlife Barrier Inspection Logs and Photographs

Attachment C.2
DMCA Inspection Log and Photographs

DMCA Wildlife Barrier Inspection Form

Monitoring Station	Photo Number	Check all that apply						Overall Condition of Barrier			Repair Needed		Comments/Observations
		Engineered surface characteristics condition compromised	Exposed underlying soil	Loss of barrier material	Down-slope movement of barrier material	Presence of debris on barrier surface	Substantial plant growth	Good	Fair	Poor	Yes	No	
DMCA 01	D1					x			x			x	Sweeping recommended
DMCA 02								x				x	
DMCA 03								x				x	
DMCA 04	D2							x				x	
DMCA 05	D3								x			x	Sweeping recommended
DMCA 06	D3								X			x	
DMCA 07								x				x	
DMCA 08								x				x	
DMCA 09	D4					x			x			x	Sweeping recommended
DMCA 10	D5, D6							x				x	
DMCA 11								x				x	
DMCA 12								x				x	
DMCA 13								x				x	

Photograph D1. Station DMCA 01 at the west border of the 1982 Dredged Material Containment Area (DMCA) with organic debris.

Photograph D2. Good conditions at Station DMCA 04 at the northeast portion of the cap.

Photograph D3. East border of the DMCA photographed to the south with notable organic debris and dust near Stations DMCA 05 and DMCA 06.

Photograph D4. Substantial organic debris and dust at the southwest corner of the cap near Station DMCA 09.

Photograph D5. Good cap conditions around the ecology blocks and structure at DMCA 10.

Photograph D6. Generally good cap conditions observed from Station DMCA 08, looking north.

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Appendix D
Post-Maintenance Photographs

Photograph 1. Area near the northwest corner of the property after landscaping and cutback of noted plant overgrowth.

Photograph 2. Photograph taken to the east from the west end of the property showing site-wide landscaping and cutback of plant overgrowth.

Photograph 3. Fence repairs along the southern portion of the west fence line.

Photograph 4. Natural reseeding at Station LLA 14 and Station LLA 15 in the area near the swale that was previously noted as requiring maintenance for vegetation loss.

Photograph 5. Natural reseeding at Station LLA 12 and LLA 18 in the area near the swale that was previously noted as requiring maintenance for vegetation loss.